A MORE DETAILS ON STEM

In this section, we provide more details on STEM, including dataset analysis, models, evaluation settings, and dataset collection.

A.1 ANALYSIS

Questions and Answers STEM contains multi-choice questions (Appendix D provides a question example for each skill). The question contains a textual description with an optional image context. Answer options are in text or in an image. We further analyze the questions from the following aspects. (i) The number of answers. STEM has averaging 2.8 answer options for each question. The distribution is presented in Figure 11. In practice, the more answer options one question has, the more difficult it is. (ii) Question type. We categorize questions based on the first three words of the question text as shown in Figure 12. STEM mostly includes factoid questions that start with words such as "which" and "what". We also show the word cloud of our STEM in Figure 13. We can see the most common words like "shape" and "number". This indicates the questions require joint reasoning of the text and images. (iii) Question distribution. Figure 14 depicts the distribution of question lengths. We can see all subjects generally follow a long-tail distribution, while math distribution is most steep and science distribution is flatter. Heuristically, longer questions are more difficult to solve. Figure 15 shows the number of questions in each grade. While pre-K has more questions, the number of questions in other grades is approximately evenly distributed.

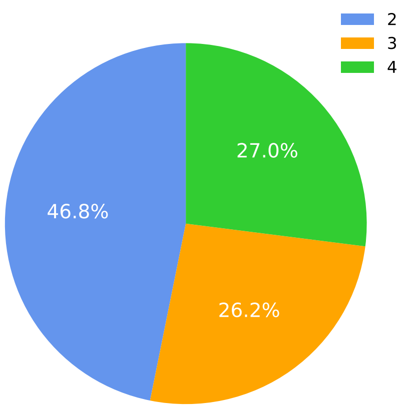


Figure 11: #Answers distribution.

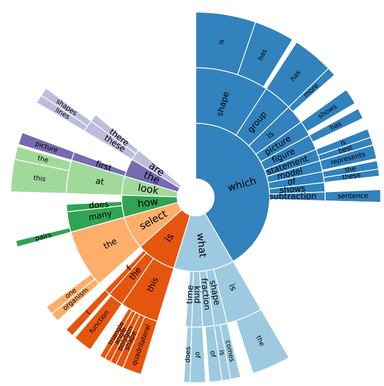


Figure 12: Question type distribution.

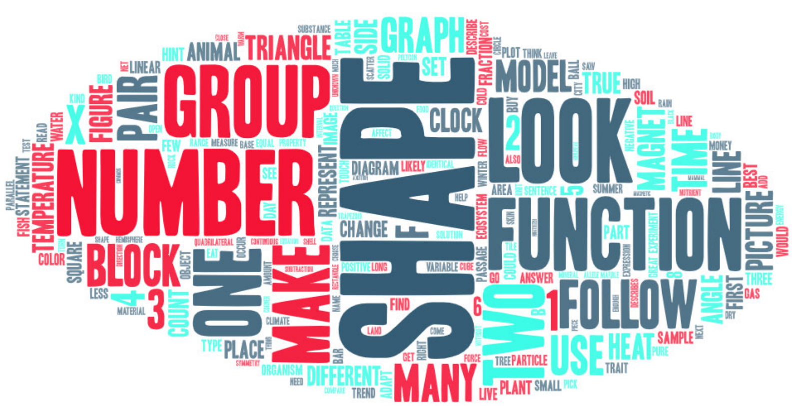


Figure 13: Word cloud of question texts in STEM.

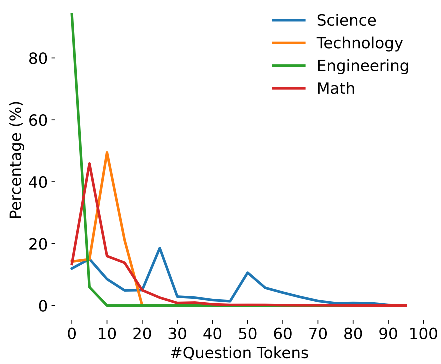


Figure 14: Question length distribution.

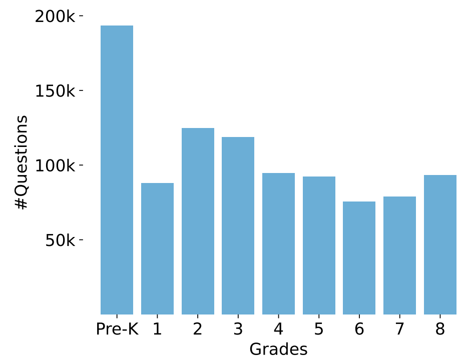


Figure 15: #Questions per grade.

Table 3: Skill comparison between STEM and existing datasets (IconQA and ScienceQA).

(a) Number of skills.

Subject	**IconQA**	**ScienceQA**	**STEM**
Science	0	167	82
Technology	0	0	9
Engineering	0	0	6
Math	13	0	351
Total	13	167	448

(b) Skill comparison between STEM and IconQA.

IconQA	**STEM**	
Counting	Count to 10, Count shapes in rows, Count sides and corners …	
Geometry	Classify triangles, Identify symmetry, Identify shapes …	
Time	Match times, Identify A.M./P.M., Read a calendar …	
…	…	
Not cover	*Science*	Compare concentrations of solutions …
	Technology	Identify peripherals …
	Engineering	Identify laboratory tools …
	Math	Linear and exponential functions …

Skill Comparison We compare the skills of STEM with other related datasets in Table 3. STEM contains the largest skill set among existing datasets, with a great number of new skills introduced to STEM that are not yet covered by existing datasets, e.g., skills in technology and engineering.

A.2 MODELS

In this section, we introduce the foundation models we benchmark in detail.

Vision-Language Models

CLIP (Radford et al., 2021). CLIP is pretrained on a sufficiently large dataset of 400 million text-image pairs across the Internet. It uses a Transformer as the text encoder, and has several variants of image encoder, including ResNet (RN) backbones and Vision Transformers (ViT) (Dosovitskiy et al., 2020). CLIP aligns the text and image representation by training on in-batch contrastive loss, and is able to zero-shot transfer to downstream vision language tasks. To align with CLIP pretraining, we formulate question answering as matching text and images. We use the cosine similarity between the text and image embeddings as the matching function, the same as the original zero-shot image-text retrieval settings in CLIP (Radford et al., 2021).

ViLBERT and 12-in-1 (Lu et al., 2019; 2020). ViLBERT adopts two parallel streams to process image regions and text segments separately, with co-attentional transformer layers connecting them. There is also a multi-task version called 12-in-1 (Lu et al., 2020) that trains 12 different tasks with individual task-specific heads sharing 1 "trunk" ViLBERT model. Its multi-modal alignment prediction serves as the matching score.

UNITER (Chen et al., 2020b). UNITER consists of an Image Embedder with Faster R-CNN (Anderson et al., 2018), a Text Embedder with Transformer (Vaswani et al., 2017), as well as a multi-layer Transformer to get cross-modality representation. During inference on STEM, the matching score function is the same as CLIP, i.e., the cosine similarity between the text and image embeddings (Chen et al., 2020b).

Virtex (Desai & Johnson, 2021). Virtex first extracts visual features with ResNet-50 (He et al., 2016) backbone. The visual features are then fed into a text head, which consists of two unidirectional Transformers, to predict captions. We extract the image feature with the image encoder, then feed text into the textual head and use the sum of bidirectional generation logits as the matching score.

Language Models

GPT-3 (Chen et al., 2020a) and GPT-3.5-Turbo (Ouyang et al., 2022). These foundation language models are generation models pretrained on a large corpus of text. We use the OpenAI API "text-davinci-002" and "gpt-3.5-turbo" corresponding to the best-performing GPT-3 and GPT-3.5-Turbo respectively. We formalize the evaluation task as a question-answering task. The input to GPT-3 and GPT-3.5-Turbo is the concatenation of the question text, the context text, and multiple answer options. The output is to predict a final answer from answer options. For images in questions, we follow Lu et al. (2022) to convert them to visual context text based on a captioning model consisting of ViT (Dosovitskiy et al., 2020) and GPT-2 (Radford et al., 2019).

UnifiedQA (Khashabi et al., 2020). UnifiedQA is a pretrained question-answering model. We use both its base and small versions. Its evaluation setup is the same as that of GPT-3 and GPT-3.5-Turbo.

GloVe (Pennington et al., 2014). GloVe is a pretrained word embedding model. We use the similarity between the average embedding of the concatenation of the question and context and the average embedding of each answer option. The answer option with the largest similarity score is the answer output. We use average pooling based on the 300-dimensional word embeddings. The images are also converted to text using the same method as GPT-3 and GPT-3.5-Turbo.

A.3 Evaluation Settings

We benchmark state-of-the-art foundation models on STEM under different settings, including zero-shot, few-shot, finetuning, and multi-task.

(i) **Zero-Shot.** We use CLIP (Radford et al., 2021), ViLBERT (Lu et al., 2019), 12-in-1 (Lu et al., 2020), UNITER (Chen et al., 2020b), and Virtex (Desai & Johnson, 2021) for the zero-shot evaluation of foundation multimodal models. CLIP is the state-of-the-art multimodal model. For zero-shot CLIP, we follow its original setup in Radford et al. (2021). The input to the text encoder is the concatenation of the question text and an answer option. The input to the image encoder is the image context. The output is the cosine similarity scores between the text embeddings and image embedding. Then the answer option with the largest similarity score serves as an answer. For questions with image answer options, the input to the image encoder will also add the image answer options.

(ii) **Few-Shot.** We also use CLIP to benchmark the multimodal few-shot results. For k-shot setup, we randomly select k questions for each skill from the training set as a meta training set. For each STEM subject, we train the model on the meta training set and select the best model on the validation set. At test time, the evaluation is the same as the zero-shot setup.

(iii) **Finetuning.** We also finetune CLIP on the entire training set for each subject. The remaining setup is the same as the few-shot setting.

(iv) **Multi-Task.** Under this setting, we train CLIP on the mixture of training sets of four subjects to produce a single model for all subjects.

A.4 Dataset Collection

We collect science, engineering and math problems from *IXL*[1], and technology problems from *ProProfs Quizzes*[2] and *Triviaplaza*[3]. We first collect multi-choice problems that have at least one image in either question context or answers. We collect at most 2,000 problems for each skill and remove duplicated problems. There are many formulas embedded in math problems that are not

[1] https://www.ixl.com/

[2] https://www.proprofs.com/quiz-school

[3] https://www.triviaplaza.com/

Table 4: Results of CLIP with different training schemes.

Method		Science	Technology	Engineering	Math	Average
CLIP	Zero-Shot	50.3	68.7	55.1	43.6	54.4
	Few-Shot	75.2	70.9	61.9	63.2	67.8
	Finetuning	87.0	71.9	67.7	78.4	76.3
	Multi-Task	86.3	60.4	73.4	77.7	74.5

represented in the text. We use the Mathpix[4] OCR API to convert these math formulas into the latex format.

B More Details on Experiments

B.1 Experimental Setup

For the zero-shot setting, we evaluate all models on the test set. For the few-shot, finetuning, and multi-task setting, we train CLIP-ViT-L/14@336px on the corresponding train set, tune hyperparameters on the valid set, and finally evaluate on the test set. We use AdamW for optimization and tune hyperparameters as follows: batch size is chosen from {16, 32, 64, 128}, and set to 16 for few-shot learning, 128 for finetuning and multi-task learning after hyperparameter tuning. The learning rate is chosen between [5e-6, 5e-5] and set to 1e-5 for all training. We set the warm-up ratio to 0.1 and set weight decay as 0.2. We set the maximum of training samples to 100k for finetuning, 200k for multitask training, and 10 epochs for few-shot training, all with early stopping on the valid set. We use NVIDIA GeForce RTX 3090 GPUs for training.

B.2 Detailed Experimental Analysis

Few-Shot In the few-shot setting, we sample different number of samples in each grade to see how the learning performance varies. Specifically, we sample 16 samples per skill and train CLIP on the sampled data. The results are shown in Table 4. We observe that CLIP gains much improvement in all subjects after few-shot learning. This implies that CLIP has already stored STEM-related knowledge and a few samples are able to trigger such knowledge. We also show performance varies when the number of samples of each skill changes (Figure 16). The overall performance improves with more samples, but 1-shot and 2-shot in technology are worse than zero-shot. Since there are only 9 skills in technology, 1-shot and 2-shot learning in technology might lead to overfitting.

Multi-Task We show the results in Table 4. Multi-task learning improves in engineering but performs worse in other subjects compared with individual finetuned models. The reason for the great drop in technology is mainly because its data is much less than other subjects. Multi-task training actually improves performance in engineering. This implies that data from one subject may be beneficial for another when the knowledge is transferable. For example, science shares many common topics with engineering like chemical experiments.

Number of Answers We also analyze how model performance changes with the number of answers. The results are shown in Figure 17. We find that for GPT-3, GPT-3.5-Turbo, CLIP zero-shot, and few-shot, the accuracy drops as the number of answers increases, but the accuracy of CLIP finetuning and multi-task does not drop. This implies that models after full training are actually solving the problem rather than guessing, so the number of choices does not affect the performance much.

Question Lengths Figure 18 shows how the question length affects model accuracy. For GPT-3, GPT-3.5-Turbo and CLIP zero-shot, the accuracy decreases slightly as the question becomes longer. For tuned models, the same trend holds for questions less than 70 tokens, but the accuracy starts to increase for longer questions. We think this may be caused by some bias in longer questions and the

[4] https://mathpix.com/

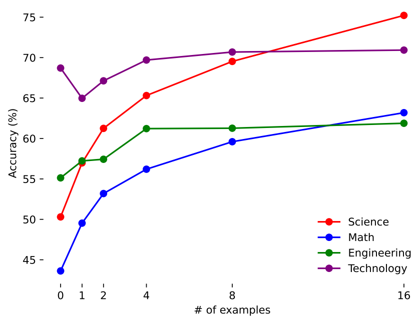


Figure 16: Result of few-shot CLIP.

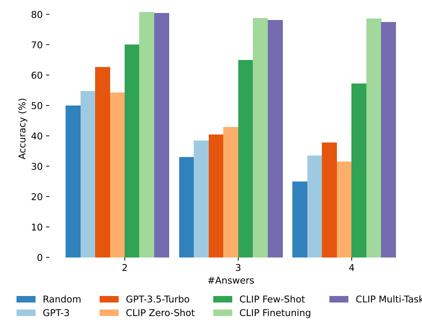


Figure 17: Results on questions with different numbers of answers.

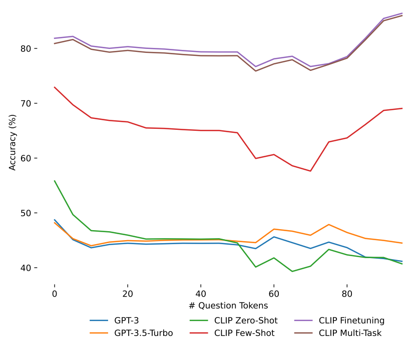


Figure 18: Results on questions with different lengths.

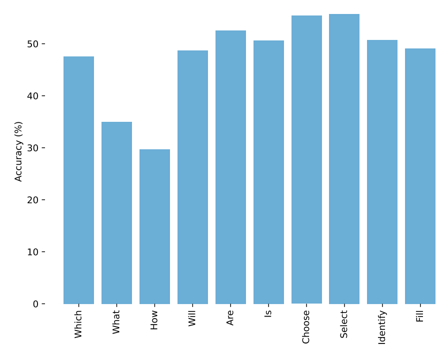


Figure 19: Zero-shot CLIP performance on different question types.

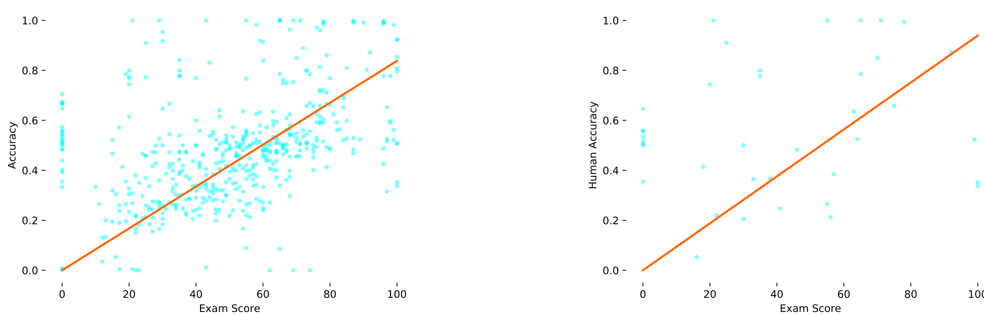


Figure 20: The correlation graphs of exam scores with model accuracy (left) and human accuracy (right).

tuned models learn such bias and achieve higher accuracy. Since there are only a small proportion of questions that are longer than 70 tokens, such bias will not affect the whole dataset much.

Question Type We mark the types of problems as the first word in the question or request of each problem. In Figure 19 we show the accuracy of the top 10 frequent types. Questions starting with "What" and "How" have relatively low accuracy, as these questions are more difficult to answer.

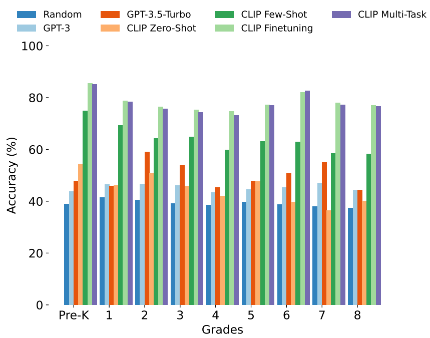


Figure 21: Average accuracies on each grade.

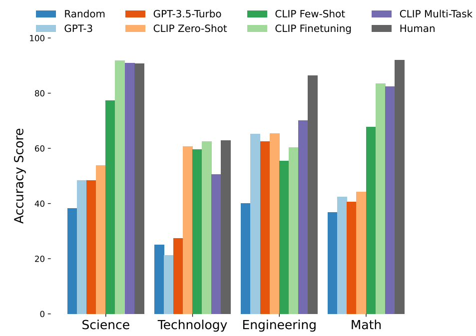


Figure 22: Accuracy on sampled STEM for human performance.

Table 5: Error analysis of CLIP on math and science subsets of STEM.

Subject	Reason	Ratio (%)
Math	Commonsense	36
	Numerical calculation	24
	Counting	16
	Read table/graph	12
	Transformation	12
Science	Comparison	40
	Commonsense	32
	Direction	20
	Read table/graph	8

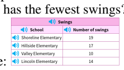
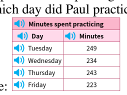
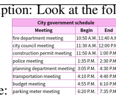
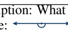
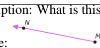
Grades We show the model accuracy on each grade in Figure 21. There is no obvious performance drop as the increase in grade levels, which is similar to the trend of exam scores. This implies the learning curve for neural models may be different from that of humans.

Correlation Between Exam Scores and Accuracy We evaluate exam scores' correlation with model accuracy and human accuracy(Figure 20). They in general positively correlated to each other. Even though exam score is different from accuracy, it overall captures accuracy as an important factor.

B.3 Error Analysis

To better understand the errors made by CLIP zero-shot, we sample 25 error cases of CLIP zero-shot on math and science. We manually check the reasons for these errors. Table 5 shows the analysis results. For math, 36% errors are caused by a lack of mathematical commonsense, such as area formulas and symmetry. Other errors include failure of calculation (24%), counting objects (16%), reading tables or graphs (12%, e.g., graphs of functions), and transformation (12%, e.g., rotation of a 3D object). For science, comparison causes the most errors with a ratio of 40%. Most of these questions only require a straightforward comparison like the distance between two pairs of magnets. However, CLIP fails on such basic problems. This indicates that it is not good at comparing objects and properties yet. Lacking science commonsense also leads to a good number of errors (32%), followed by identifying directions (20%, e.g., the directions of push and pull, towards and away) and reading tables or graphs (8%).

Moreover, we show the top-5 skills with the most errors of fine-tuned models on math and science subsets in Table 6 and Table 7 respectively.

<table>
<tr><th>Skill</th><th>Error Rate</th><th>Example</th></tr>
<tr><td>greatest-and-least-word-problems-up-to-100</td><td>76.8%</td><td>Description: The school district compared how many swings each elementary school has. Which school has the fewest swings?
Picture: 
<table><tr><th colspan="2">Swings</th></tr><tr><th>School</th><th>Number of swings</th></tr><tr><td>Shoreline Elementary</td><td>19</td></tr><tr><td>Hillside Elementary</td><td>17</td></tr><tr><td>Valley Elementary</td><td>10</td></tr><tr><td>Lincoln Elementary</td><td>14</td></tr></table>
Choices: [Shoreline Elementary, Hillside Elementary, Valley Elementary, Lincoln Elementary,]
Answer index: 2
Prediction: 0</td></tr>
<tr><td>greatest-and-least-word-problems-up-to-1000</td><td>76.0%</td><td>Description: Paul kept a log of how many minutes he spent practicing ice skating over the past 4 days. On which day did Paul practice the least?
Picture: 
<table><tr><th colspan="2">Minutes spent practicing</th></tr><tr><th>Day</th><th>Minutes</th></tr><tr><td>Tuesday</td><td>249</td></tr><tr><td>Wednesday</td><td>234</td></tr><tr><td>Thursday</td><td>243</td></tr><tr><td>Friday</td><td>223</td></tr></table>
Choices: [Tuesday, Wednesday, Thursday, Friday,]
Answer index: 3
Prediction: 2</td></tr>
<tr><td>reading-schedules</td><td>75.0%</td><td>Description: Look at the following schedule: Which meeting ends at 12:00 P.M.?
Picture: 
<table><tr><th colspan="3">City government schedule</th></tr><tr><th>Meeting</th><th>Begin</th><th>End</th></tr><tr><td>fire department meeting</td><td>10:50 A.M.</td><td>11:40 A.M.</td></tr><tr><td>city council meeting</td><td>11:30 A.M.</td><td>12:00 P.M.</td></tr><tr><td>construction permit meeting</td><td>11:50 A.M.</td><td>1:00 P.M.</td></tr><tr><td>police meeting</td><td>1:35 P.M.</td><td>2:30 P.M.</td></tr><tr><td>planning department meeting</td><td>3:05 P.M.</td><td>4:30 P.M.</td></tr><tr><td>transportation meeting</td><td>4:10 P.M.</td><td>4:40 P.M.</td></tr><tr><td>budget meeting</td><td>4:55 P.M.</td><td>6:10 P.M.</td></tr><tr><td>parking meter meeting</td><td>6:20 P.M.</td><td>7:35 P.M.</td></tr></table>
Choices: [the city council meeting, the construction permit meeting, the parking meter meeting, the police meeting,]
Answer index: 0
Prediction: 2</td></tr>
<tr><td>angles-of-90-180-270-and-360-degrees</td><td>73.8%</td><td>Description: What fraction of a turn is this angle?
Picture: 
Choices: [3/4, 1 full turn, 1/2, 1/4,]
Answer index: 2
Prediction: 3</td></tr>
<tr><td>points-lines-line-segments-rays-and-angles</td><td>73.8%</td><td>Description: What is this?
Picture: 

Choices: [a line segment, a ray, a line, a point,]
Answer index: 1
Prediction: 0</td></tr>
</table>

Table 6: Error analysis of top-5 skills with most errors on math.

B.4 Comparison with Human

Exam Score We test exam scores on all skills in engineering and technology, and randomly choose 40 skills from math, and 30 skills from science due to technical and time constraints. We compare neural models with humans using the exam score, and the results are shown in Table 8. The detailed scores and skills are listed in Table 10.

Accuracy We randomly sample 20 problems for each subject and ask 7 Ph.D. students to answer these questions, and calculate the average accuracy for each subject. To evaluate neural models on these questions, we use the corresponding skill accuracy for each sampled problem as the models' score on this problem and average all accuracy together as the final score. We do not evaluate models on these sampled data directly since the small number of samples will lead to a large variance, and skill accuracy can avoid such variance. The comparison results are shown in Table 8 and Figure 22. All sampled problems are listed in Table 12 to 17.

B.5 Zero-Shot Prompt Sensitivity

We study the effect of prompts on CLIP zero-shot. We design 5 types of prompts and demonstrate them with an example problem. The example question is "Which property matches this object?" and the answer is "Rough". Examples of different prompt types and the corresponding accuracies are shown in Table 9. We observe that "Q+A results in the best performance on average, but the difference is only marginal, meaning that CLIP zero-shot is not very sensitive to the format of prompts.

B.6 Detailed Performance on Skills

We show the accuracy of neural models on all 448 skills in Figure 23 to 28. We can see that the zero-shot performance is generally better than random guesses on most skills and achieves near 100% on some skills (e.g., "circles" and "cones"). After finetuning, accuracy improves on most skills and becomes near 100% on many skills.

B.7 VQA Results

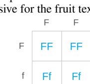
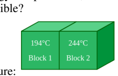
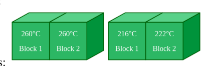
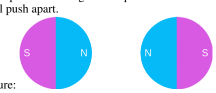
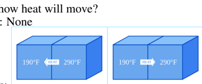
Skill	Error Rate	Example
use-punnett-squares-to-calculate-ratios-of-offspring-types	69.10%	Description: This passage describes the antenna type trait in fruit flies: Most fruit flies have a pair of antennae on their head. But, some flies appear to have an extra pair of legs on their head instead! These flies have a mutation, or change, in a gene that affects body development. This mutation makes the cells in the fly's head form mutated antennae that are like legs. In a group of fruit flies, some individuals have mutated antennae and others have normal antennae. In this group, the gene for the antenna type trait has two alleles. The allele for normal antennae (a) is recessive to the allele for mutated antennae (A). This Punnett square shows a cross between two fruit flies. What is the expected ratio of offspring with normal antennae to offspring with mutated antennae? Choose the most likely ratio.  Picture: Choices: [0:4, 3:1, 2:2, 1:3, 4:0,] Answer index: 0 Prediction: 3
use-punnett-squares-to-calculate-probabilities-of-offspring-types	60.10%	Description: In a group of tomato plants, some individuals have smooth fruit and others have fuzzy fruit. In this group, the gene for the fruit texture trait has two alleles. The allele for smooth fruit (F) is dominant over the allele for fuzzy fruit (f). This Punnett square shows a cross between two tomato plants. What is the probability that a tomato plant produced by this cross will be homozygous recessive for the fruit texture gene?  Picture: Choices: [0/4, 1/4, 2/4, 3/4, 4/4,] Answer index: 0 Prediction: 3
predict-temperature-changes	55.00%	Description: Two identical blocks are heated to different temperatures. The blocks are placed so that they touch, and heat begins to flow between the blocks. The pair of blocks is insulated, so no energy escapes. Later, the temperature of each block is measured again. Which pair of temperatures is possible?  Picture:  Choices: Answer index: 1 Prediction: 0
identify-magnets-that-attract-or-repel	21.10%	Description: Two magnets are placed as shown. Hint: Magnets that attract pull together. Magnets that repel push apart.  Picture: Choices: [attract, repel,] Answer index: 1 Prediction: 0
predict-heat-flow	16.20%	Description: Two solid blocks are at different temperatures. The blocks are touching. Which picture shows how heat will move? Picture: None  Choices: Answer index: 0 Prediction: 1

Table 7: Error analysis of top-5 skills with most errors on science.

Table 8: Comparison between models and humans.

Method		Exam Score				Accuracy			
		Science	Engineering	Math	Technology	Science	Technology	Engineering	Math
Human		90.0	90.0	90.0	68.6	90.7	62.9	86.4	92.1
Random		26.7	16.1	51.1	25.0	38.3	25.0	40.0	36.8
GPT-3		45.7	50.2	51.4	22.1	48.4	21.3	65.2	42.4
GPT-3.5-Turbo		48.9	58.7	53.5	26.3	48.5	27.4	62.5	40.6
CLIP	Zero-Shot	33.9	19.0	52.9	68.7	53.8	60.7	65.5	44.3
	Few-Shot	39.1	43.9	67.6	70.9	77.3	59.7	55.5	67.8
	Finetuning	57.8	37.4	75.7	71.9	91.9	62.6	60.3	83.5
	Multi-Task	61.9	50.3	72.0	60.4	90.9	50.6	70.2	82.5

Table 9: Examples for different prompts and their zero-shot accuracy.

Prompt Format	Example	Science	Technology	Engineering	Math	Average
Q+A	Which property matches this object? Rough.	50.3	68.7	55.1	43.6	54.4
A+Q	Rough. Which property matches this object?	50.0	66.0	49.6	43.2	52.2
Q "Choose the best answer:" A	Which property matches this object? **Choose the best answer:** Rough.	50.1	70.7	49.7	44.2	53.7
"Answer the question:" Q + A	**Answer the question:** Which property matches this object? Rough.	49.4	67.6	51.0	43.6	52.9
A "best answers the question" Q	Rough **best answers the question:** Which property matches this object?	49.7	69.5	50.8	43.8	53.4

We evaluate the zero-shot CLIP model and models finetuned on each subject on the VQA (Antol et al., 2015) dataset. Results are shown in Table 11. The average increase of the finetuned models over the zero-shot setting is 1.2%.

Model	Accuracy
Zero-Shot CLIP	24.7%
Finetuning with Science	27.3%
Finetuning with Technology	26.5%
Finetuning with Engineering	24.8%
Finetuning with Math	24.9%

Table 11: Results on the VQA (Antol et al., 2015) dataset.

C Additional Related Work

In addition to vision-language foundation models included in the main text, we expand the discussion to some recent models, including BLIP-2 (Li et al., 2023), EVA-ClIP (Sun et al., 2023), and KOSMOS-2 (Peng et al., 2023). BLIP-2 provides a versatile and efficient strategy for pre-training. This strategy enhances the vision-language pre-training process by utilizing frozen pre-trained image encoders and frozen large language models, while EVA-CLIP proposes a series of methods to increase the training efficiency of the CLIP model. KOSMOS-2 enables new capabilities for perceiving object descriptions. This work focuses on the creation of a dataset to evaluate the multimodal STEM understanding and we chose the foundation models like CLIP for a pilot study on our dataset. There are more benchmarks targeting formal math reasoning (Zheng et al., 2022; Liu et al., 2023; Xiong et al., 2023b), however, they are all restricted to single text modality and they can not evaluate fundamental skills.

D Summary of Skills

We list all skills in `STEM` in Table 18 to 20 and show some examples in Table 21 to 27.

Subject	Grade/Skill	Random	Zero-shot	Finetune
Science	grade-2/classify-matter-as-solid-liquid-or-gas	28	40	100
	grade-2/identify-animals-with-and-without-backbones	0	70	70
	grade-2/identify-mammals-birds-fish-reptiles-and-amphibians	0	0	18
	grade-2/identify-materials-in-objects	21	40	100
	grade-2/identify-properties-of-an-object	35	65	65
	grade-3/compare-strengths-of-magnetic-forces	0	18	63
	grade-3/describe-ecosystems	65	50	100
	grade-3/find-evidence-of-changes-to-earths-surface	17	38	100
	grade-3/identify-ecosystems	35	100	100
	grade-3/identify-minerals-using-properties	35	11	35
	grade-4/compare-properties-of-objects	10	17	20
	grade-4/describe-ecosystems	74	100	100
	grade-4/identify-minerals-using-properties	35	16	35
	grade-4/use-evidence-to-classify-mammals-birds-fish-reptiles-and-amphibians	26	35	35
	grade-5/animal-adaptations-beaks-mouths-and-necks	17	27	35
	grade-5/classify-elementary-substances-and-compounds-using-models	75	75	75
	grade-5/compare-ancient-and-modern-organisms-use-observations-to-support-a-hypothesis	32	32	50
	grade-5/identify-directions-of-forces	0	26	35
	grade-5/identify-the-photosynthetic-organism	0	0	100
	grade-5/predict-temperature-changes	0	22	0
	grade-5/use-evidence-to-classify-animals	35	35	35
	grade-5/use-evidence-to-classify-mammals-birds-fish-reptiles-and-amphibians	18	35	35
	grade-5/weather-and-climate-around-the-world	60	36	60
	grade-6/compare-concentrations-of-solutions	15	11	100
	grade-6/describe-the-effects-of-gene-mutations-on-organisms	52	13	69
	grade-6/diffusion-across-membranes	50	25	50
	grade-7/describe-the-effects-of-gene-mutations-on-organisms	42	13	69
	grade-8/classify-symbiotic-relationships	25	36	45
	grade-8/diffusion-across-membranes	0	18	35
	grade-8/moss-and-fern-life-cycles	0	12	0
Engineer	grade-6/evaluate-tests-of-engineering-design-solutions	0	0	100
	grade-6/identify-control-and-experimental-groups	0	0	0
	grade-6/identify-independent-and-dependent-variables	0	0	100
	grade-6/identify-the-experimental-question	30	30	30
	grade-7/evaluate-tests-of-engineering-design-solutions	0	0	0
	grade-7/identify-control-and-experimental-groups	0	0	40
	grade-7/identify-independent-and-dependent-variables	0	0	30
	grade-7/identify-the-experimental-question	40	0	40
	grade-8/identify-control-and-experimental-groups	0	0	0
	grade-8/identify-the-experimental-question	60	0	40
	grade-5/identify-laboratory-tools	21	42	31
	grade-6/identify-laboratory-tools	21	21	21
	grade-6/laboratory-safety-equipment	24	65	52
	grade-7/identify-laboratory-tools	10	28	21
	grade-7/laboratory-safety-equipment	9	58	52
	grade-8/identify-laboratory-tools	49	21	21
	grade-8/laboratory-safety-equipment	9	58	58
Math	algebra-2/factor-quadratics-using-algebra-tiles	40	51	55
	algebra-2/outliers-in-scatter-plots	55	47	97
	calculus/determine-continuity-using-graphs	36	63	80
	calculus/find-limits-at-vertical-asymptotes-using-graphs	60	65	85
	grade-1/subtraction-sentences-up-to-10-which-model-matches	50	30	99
	grade-2/identify-halves-thirds-and-fourths	65	75	97
	grade-2/identify-lines-of-symmetry	70	64	99
	grade-2/interpret-bar-graphs-ii	14	23	12
	grade-2/ordinal-numbers-up-to-10th	32	61	28
	grade-3/compare-fractions-in-recipes	55	50	68
	grade-3/identify-parallelograms	51	64	70
	grade-3/is-it-a-polygon	71	60	98
	grade-3/parallel-sides-in-quadrilaterals	29	66	45
	grade-4/nets-of-three-dimensional-figures	68	40	99
	grade-5/nets-of-three-dimensional-figures	53	40	99
	grade-6/changes-in-mean-median-mode-and-range	38	14	15
	grade-6/classify-triangles	47	38	45
	grade-6/identify-polyhedra	75	75	75
	grade-6/mean-median-mode-and-range-find-the-missing-number	55	41	99
	grade-6/model-and-solve-equations-using-algebra-tiles	36	36	57
	grade-6/rational-numbers-find-the-sign	31	78	99
	grade-6/rotational-symmetry	62	56	78
	grade-6/similar-and-congruent-figures	34	33	46
	grade-6/which-figure-is-being-described	36	27	86
	grade-7/rational-numbers-find-the-sign	47	58	99
	grade-8/rotational-symmetry-amount-of-rotation	47	32	63
	kindergarten/count-on-ten-frames-up-to-10	15	2	49
	kindergarten/fewer-and-more-up-to-20	80	62	97
	kindergarten/subtraction-sentences-up-to-5-which-model-matches	41	30	96
	pre-k/addition-sentences-up-to-10-which-model-matches	60	55	96
	pre-k/count-on-ten-frames-up-to-3	84	50	51
	pre-k/fewer-and-more-compare-by-matching	63	52	90
	pre-k/one-less-with-pictures-up-to-10	61	37	66
	pre-k/one-more-with-pictures-up-to-5	48	36	75
	pre-k/shapes-of-everyday-objects	67	96	96
	pre-k/spheres	67	96	96
	pre-k/triangles	57	75	75
	pre-k/what-comes-next	75	56	70
	pre-k/ordinal-numbers-up-to-tenth	27	84	82
	kindergarten/are-there-enough	40	99	96

Table 10: Exam scores for each skill.

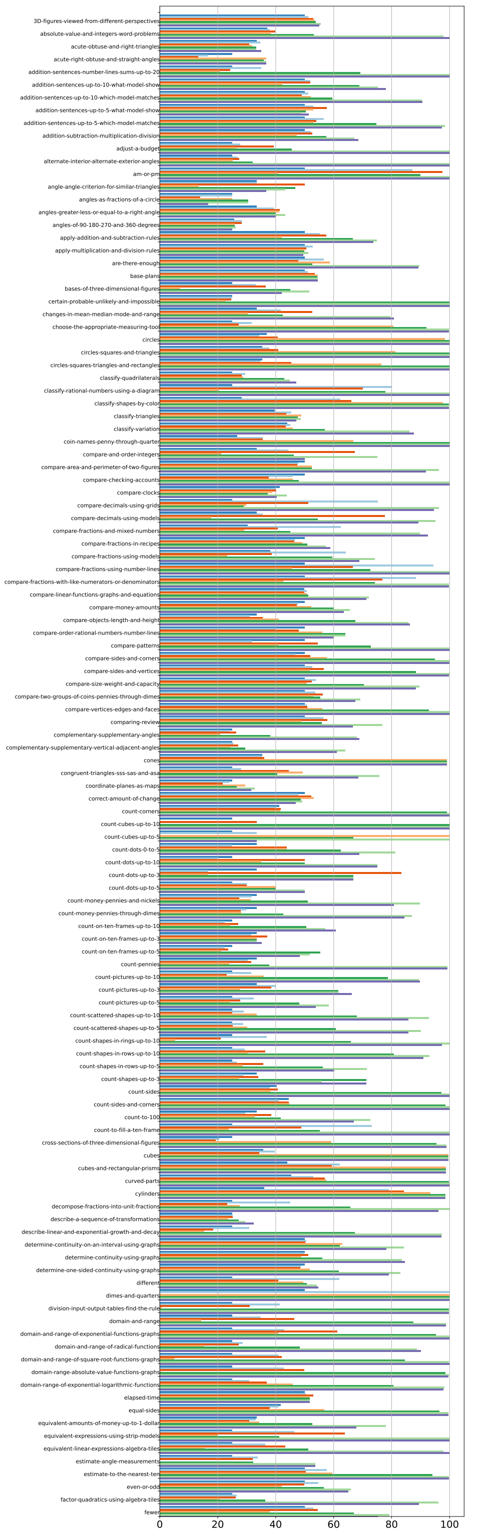


Figure 23: Accuracy per skill on math (part 1).

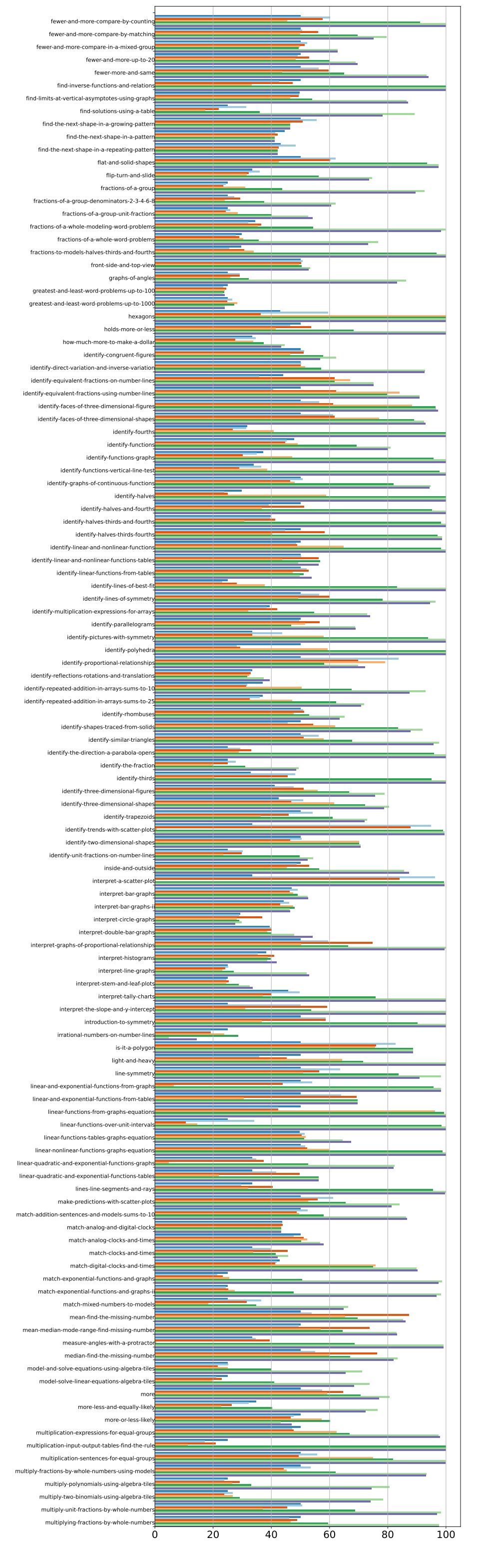


Figure 24: Accuracy per skill on math (part 2).

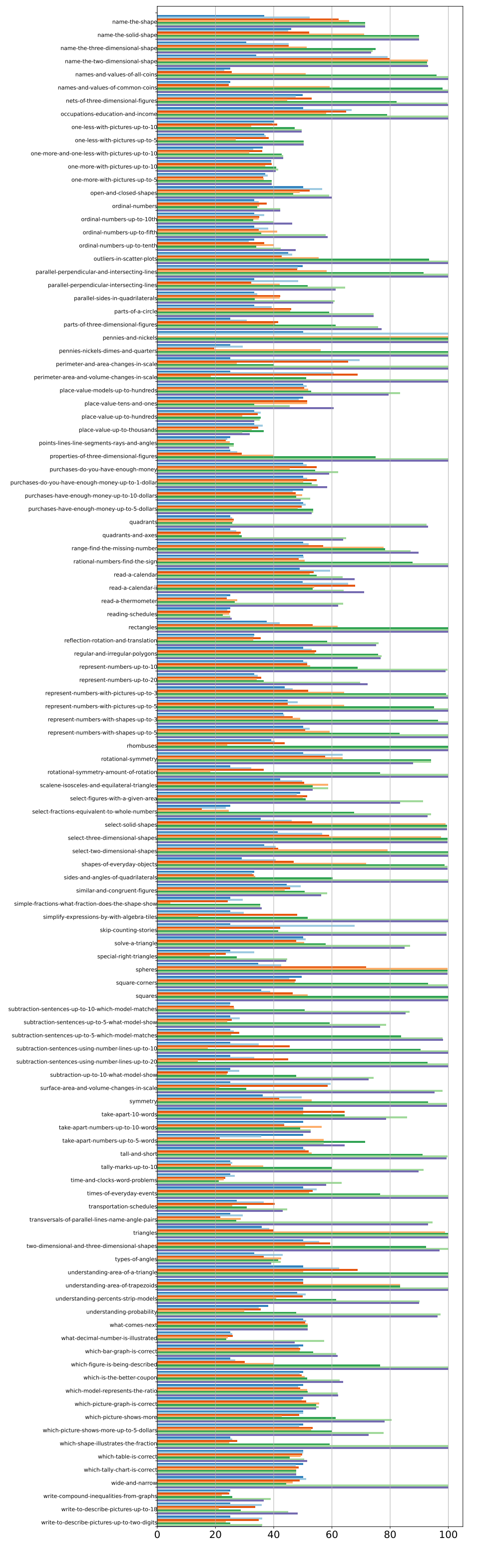


Figure 25: Accuracy per skill on math (part 3).

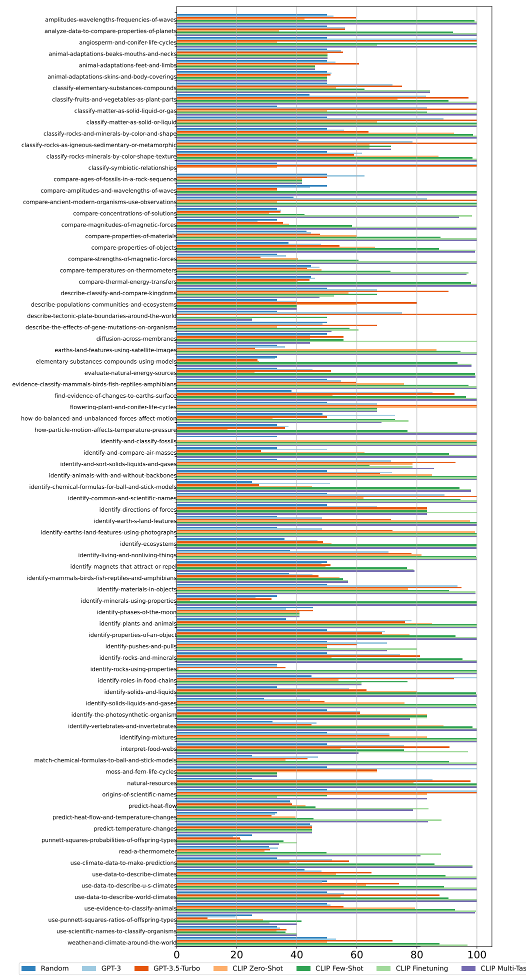


Figure 26: Accuracy per skill on science.

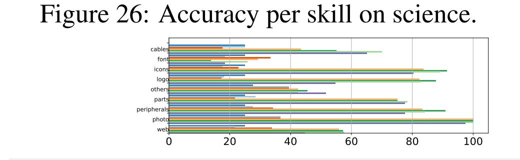


Figure 27: Accuracy per skill on technology.

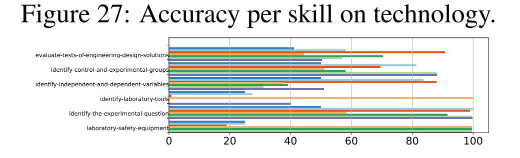


Figure 28: Accuracy per skill on engineering.

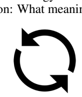
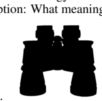
Subject: Technology Description: This is a(n old) logo of which famous app or program? Picture: Choices: [Microsoft Office Outlook, Microsoft Office OneDrive, OfficeSuite Pro, Opera,] Answer index: 3	Subject: Technology Description: What kind of computer component do you see here?  Picture: Choices: [TV Tuner Card, PC Card, Motherboard, Modem Card,] Answer index: 2
Subject: Technology Description: This is (part of) a (former) logo of which computer related brand? Picture: Choices: [ASRock, Amiga Inc., Arctic, ATI Technologies,] Answer index: 3	Subject: Technology Description: This is (part of) a (former) logo of which computer related brand? Picture: Choices: [Fujitsu, Samsung, Iiyama, Brother,] Answer index: 2
Subject: Technology Description: This is (part of) a (former) logo of which computer related brand? Picture: Choices: [Xiaomi, Cisco, Intel, Wii,] Answer index: 3	Subject: Technology Description: What kind of computer component do you see here?  Picture: Choices: [Display Adapter/Video Card, PC Card, Power Supply Unit, Hard Disk Drive,] Answer index: 3
Subject: Technology Description: What meaning or function is usually associated with this web interface symbol?  Picture: Choices: [Paste, Search, Tip/Idea, Calendar/Event,] Answer index: 2	Subject: Technology Description: This is a(n old) logo of which famous app or program? Picture: Choices: [YouTube Music, Beats Music, MX Player, YouTube,] Answer index: 2
Subject: Technology Description: What kind of computer related plug or port do you see here?  Picture: Choices: [USB type-C plug, DVI plug (type D), HDMI plug, 3.5mm Audio Cable plug,] Answer index: 0	Subject: Technology Description: Identify this font type ActionQuiz Picture: Choices: [Lucida MT, News Gothic MT, Fixedsys, Courier New,] Answer index: 2
Subject: Technology Description: Identify this font type ActionQuiz Picture: Choices: [Commercial Script BT, Brush Script MT, Vivaldi D, ShelleyVolante BT,] Answer index: 3	Subject: Technology Description: Identify this font type ActionQuiz Picture: Choices: [Garamond, Times New Roman, Courier New, Georgia,] Answer index: 3
Subject: Technology Description: This is (part of) a (former) logo of which computer related brand? Picture: Choices: [BenQ, Lexmark, Creative Technology, Lenovo,] Answer index: 2	Subject: Technology Description: Identify this font type ActionQuiz Picture: Choices: [Webdings, Courier, Impact, System,] Answer index: 3
Subject: Technology Description: Identify this font type ActionQuiz Picture: Choices: [Serifa BT, Stylus ITC, Calisto MT, Tempus Sans ITC,] Answer index: 0	Subject: Technology Description: What meaning or function is usually associated with this web interface symbol?  Picture: Choices: [Pin/Make something sticky, Storage for deleted files, Options/Settings, Print (preview),] Answer index: 1
Subject: Technology Description: What meaning or function is usually associated with this web interface symbol?  Picture: Choices: [Zoom in, Help, Like something, Link select,] Answer index: 3	Subject: Technology Description: What meaning or function is usually associated with this web interface symbol?  Picture: Choices: [Apply, Options/Settings, Reload/Refresh, Download,] Answer index: 2
Subject: Technology Description: What type of video game console do you see here?  Picture: Choices: [Mattel Intellivision, Sega Master System, Magnavox Odyssey 2, Atari 5200,] Answer index: 3	Subject: Technology Description: What meaning or function is usually associated with this web interface symbol?  Picture: Choices: [Find, Delete, Attachment, Calendar/Event,] Answer index: 0

Table 12: Human evaluation problem set (part 1).

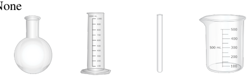
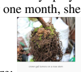
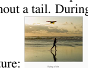
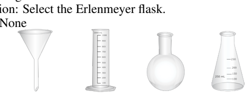
Subject: Engineer Description: Select the gloves. Picture: None  Choices: Answer index: 0	Subject: Engineer Description: iption: In this experiment, which were part of an experimental group? The passage below describes an experiment. Lucy and Erik were taking a snowboarding class. During the class, their instructor said they would go faster if they applied wax to the undersides of their snowboards. After the class, Lucy applied a thin layer of wax to the underside of a snowboard and rode the board straight down a hill. Then, she removed the wax and rode the snowboard straight down the hill again. Erik timed how long each ride took. Lucy repeated these rides on four other snowboards, alternating whether she first rode with or without wax.  Picture: Choices: [the snowboards with wax removed, the snowboards with wax added,] Answer index: 1
Subject: Engineer Description: Select the test tube. Picture: None  Choices: Answer index: 2	Subject: Engineer Description: Select the funnel. Picture: None  Choices: Answer index: 2
Subject: Engineer Description: Select the round-bottom flask. Picture: None  Choices: Answer index: 1	Subject: Engineer Description: iption: In this experiment, which were part of an experimental group? The passage below describes an experiment. Kimberly grew roses for a flower shop. One day, she noticed tumor-like growths on her rose stems. She could tell that the plants had crown gall disease, which is caused by a type of bacteria. She knew that allicin, a chemical in garlic, can kill bacteria. Kimberly wondered if spraying her plants with garlic juice would prevent more tumors from forming on her plants. Once a day, Kimberly sprayed garlic juice on ten infected plants and left another 10 infected plants unsprayed. After one month, she compared the number of new tumors on plants in the two groups.  Picture: Choices: [the roses sprayed with garlic juice, the roses that were not sprayed,] Answer index: 0
Subject: Engineer Description: iption: Which of the following could Kendra's test show? Wind turbines use wind power to produce electricity. Kendra was a materials engineer who designed wind turbines. She wanted to design a new turbine that would produce 10% more electricity than older wind turbines. She thought that a turbine made from lightweight material would turn more easily and produce more electricity. So, Kendra created a computer model of a turbine made from lightweight material. Then she used the model to calculate how much more electricity the new turbine could produce compared to the older turbines. The passage below describes how the engineering-design process was used to test a solution to a problem. Read the passage. Then answer the question below.  Picture: Choices: [how much the new turbine would weigh, whether the new turbine could produce 10% more electricity, if the new turbine could turn easily,] Answer index: 1	Subject: Engineer Description: iption: In this experiment, which were part of an experimental group? The passage below describes an experiment. Isaac and his friend Belle flew nylon kites on the beach. They wondered if putting a tail on a kite would affect how well the kite flew. Isaac flew a kite that did not have a tail for five minutes. Then, he attached a four-foot-long tail and flew the kite for five more minutes. Isaac repeated this with three similar kites, alternating whether he started the kite with or without a tail. During each flight, Belle counted the number of times the kite crashed to the ground.  Picture: Choices: [the kites without tails, the kites with tails,] Answer index: 1
Subject: Engineer Description: iption: Identify the question that Bryant and Lamar's experiment can best answer. The passage below describes an experiment. Read the passage and then follow the instructions below. Bryant placed a ping pong ball in a catapult, pulled the catapult's arm back to a 45° angle, and launched the ball. Then, Bryant launched another ping pong ball, this time pulling the catapult's arm back to a 30° angle. With each launch, his friend Lamar measured the distance between the catapult and the place where the ball hit the ground. Bryant and Lamar repeated the launches with ping pong balls in four more identical catapults. They compared the distances the balls traveled when launched from a 45° angle to the distances the balls traveled when launched from a 30° angle.  Picture: Choices: [Do ping pong balls stop rolling along the ground sooner after being launched from a 30° angle or a 45° angle?, Do ping pong balls travel farther when launched from a 30° angle compared to a 45° angle?,] Answer index: 1	Subject: Engineer Description: Select the Erlenmeyer flask. Picture: None  Choices: Answer index: 3

Table 13: Human evaluation problem set (part 2).

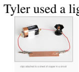
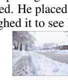
Subject: Engineer Description: iption: Which of the following could Ivan's test show? Ivan was a landscape architect who was hired to design a new city park. The city council wanted the park to have space for outdoor concerts and to have at least 20% of the park shaded by trees. Ivan thought the concert area should be at least 150 meters from the road so traffic noise didn't interrupt the music. He developed three possible designs for the park with the concert area in a different location in each design. Then, he tested each design by measuring the distance between the road and the concert area. The passage below describes how the engineering-design process was used to test a solution to a problem. Read the passage. Then answer the question below. Picture:  Choices: [if at least 20% of the park would be shaded by trees in each design, which design would have the greatest distance between the concert area and the road, which design would have the least traffic noise in the concert area,] Answer index: 1	Subject: Engineer Description: Select the beaker. Picture: None Choices:  Answer index: 3
Subject: Engineer Description: iption: Identify the question that Zeke's experiment can best answer. The passage below describes an experiment. Read the passage and then follow the instructions below. Zeke divided 40 unripe bananas evenly among eight paper bags and sealed the bags. He poked 20 small holes in four of the bags and left the other four without holes. He kept the bags at room temperature for three days. Then, Zeke opened the bags and counted the number of brown spots on each banana. He compared the average number of brown spots on bananas from bags with holes to the average number of brown spots on bananas from bags without holes. Picture:  Choices: [Do bananas develop more brown spots if they are kept in bags with holes compared to bags without holes?, Do bananas develop more brown spots when they are kept at room temperature compared to in a cold refrigerator?,] Answer index: 0	Subject: Engineer Description: iption: Hint: An independent variable is a variable whose effect you are investigating. A dependent variable is a variable that you measure. Which of the following was an independent variable in this experiment? The passage below describes an experiment. Read the passage and think about the variables that are described. Tyler designed an electric circuit to test how well different types of metal conduct electricity. The circuit included a battery, a light bulb, wires, and clips that could be attached to a sheet of metal. If the metal conducted electricity poorly, the light bulb would appear dim. If the metal conducted electricity well, the light bulb would appear bright. Tyler collected nine equally sized sheets of metal: three sheets of copper, three sheets of iron, and three sheets of aluminum. He used the clips to attach each metal sheet, one sheet at a time, to the circuit. For each sheet, Tyler used a light meter to measure how much light the bulb produced. Picture:  Choices: [the amount of light produced by the light bulb, the type of metal sheet used in the circuit,] Answer index: 1
Subject: Engineer Description: iption: Identify the question that Devon's experiment can best answer. The passage below describes an experiment. Read the passage and then follow the instructions below. Devon poured four ounces of water into each of six glasses. Devon dissolved one tablespoon of salt in each of three glasses, and did not add salt to the other three. Then, Devon placed an egg in one glass and observed if the egg floated. She removed the egg and dried it. She repeated the process with the other five glasses, recording each time if the egg floated. Devon repeated this test with two more eggs and counted the number of times the eggs floated in fresh water compared to salty water. Picture:  Choices: [Does the amount of water in a glass affect whether eggs sink or float in the water?, Are eggs more likely to float in fresh water or salty water?,] Answer index: 1	Subject: Engineer Description: iption: Which of the following could Luke's test show? Luke had a cookie recipe that made soft, thick cookies. Luke read that using different types of sugar affects how firm the cookies are. His recipe used both white and brown sugar, so he decided to see if the cookies would be crunchy if he didn't use any brown sugar. Luke baked a batch of cookies using his recipe, but he left out the brown sugar and doubled the amount of white sugar. He baked the cookies for the same amount of time as in his original recipe. After the cookies finished baking and cooling, he tried one to find out how firm it was. The passage below describes how the engineering-design process was used to test a solution to a problem. Read the passage. Then answer the question below. Picture:  Choices: [if cookies made with only white sugar were soft, if baking cookies for longer made them more crunchy, if cookies made with double the amount of brown sugar were crunchy,] Answer index: 0
Subject: Engineer Description: iption: Identify the question that Myra's experiment can best answer. The passage below describes an experiment. Read the passage and then follow the instructions below. Myra glued lids onto 16 cardboard shoe boxes of equal size. She painted eight of the boxes black and eight of the boxes white. Myra made a small hole in the side of each box and then stuck a thermometer partially into each hole so she could measure the temperatures inside the boxes. She placed the boxes in direct sunlight in her backyard. Two hours later, she measured the temperature inside each box. Myra compared the average temperature inside the black boxes to the average temperature inside the white boxes. Picture:  Choices: [Do the temperatures inside boxes depend on the sizes of the boxes?, Do the insides of white boxes get hotter than the insides of black boxes when the boxes are left in the sun?,] Answer index: 1	Subject: Engineer Description: iption: Which of the following could Zoe and Evelyn's test show? Zoe and Evelyn were making batches of concrete for a construction project. To make the concrete, they mixed together dry cement powder, gravel, and water. Then, they checked if each batch was firm enough using a test called a slump test. They poured some of the fresh concrete into an upside-down metal cone. They left the concrete in the metal cone for 30 seconds. Then, they lifted the cone to see if the concrete stayed in a cone shape or if it collapsed. If the concrete in a batch collapsed, they would know the batch should not be used. The passage below describes how the engineering-design process was used to test a solution to a problem. Read the passage. Then answer the question below. Picture:  Choices: [if the concrete from each batch took the same amount of time to dry, if a new batch of concrete was firm enough to use,] Answer index: 1
Subject: Engineer Description: iption: Identify the question that Belle's experiment can best answer. The passage below describes an experiment. Read the passage and then follow the instructions below. Belle planted 25 tomato seeds one-half inch below the soil surface in each of six pots. Belle added an equal amount of fertilizer to three of the six pots. She placed the pots in a plant growth chamber where all the seeds experienced the same temperature, amount of light, and humidity level. After two weeks, Belle counted the number of seedlings that grew in each pot. She compared the number of seedlings in the pots with fertilizer to the number of seedlings in the pots without fertilizer. Picture:  Choices: [Do more tomato seedlings grow when they are planted in soil with fertilizer compared to soil without fertilizer?, Does the humidity level where tomato seeds are planted affect the number of tomato seedlings that grow?,] Answer index: 0	Subject: Engineer Description: iption: In this experiment, which were part of a control group? The passage below describes an experiment. After a severe winter storm, Sandeep's driveway was covered with ice. He read that salt makes ice melt at a lower temperature. Before covering his entire driveway with salt, he wanted to know if adding salt could actually help melt ice in the freezing outdoor temperatures. Sandeep weighed twenty ice cubes. He sprinkled salt on half of the ice cubes and left the other half unsalted. He placed all the ice cubes outside. One hour later, Sandeep quickly dried each ice cube and reweighed it to see how much it had melted. Picture:  Choices: [the salted ice cubes, the unsalted ice cubes,] Answer index: 1

Table 14: Human evaluation problem set (part 3).

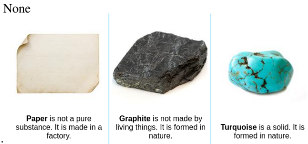
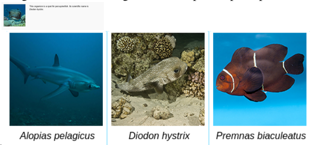
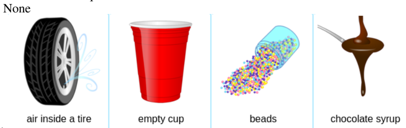
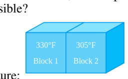
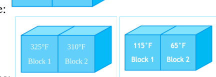
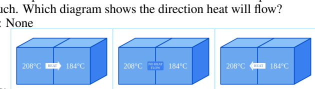
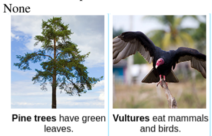
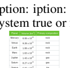
Subject: Science Description: Select the gray mineral. Picture: None  Choices: Answer index: 1	Subject: Science Description: Select the one substance that is not a mineral. Picture: None  Choices: Answer index: 0
Subject: Science Description: iption: This organism is a spot-fin porcupinefish. Its scientific name is Diodon hystrix. Select the organism in the same genus as the spot-fin porcupinefish. Picture:   Choices: Answer index: 1	Subject: Science Description: Select the liquid. Picture: None  Choices: Answer index: 3
Subject: Science Description: iption: Fish are a group of animals with similar traits. The following traits can be used to identify fish: They have fins, not limbs. They make eggs with no shells. Observe the animals and read the descriptions. Select the one animal that has all of the fish traits listed above. Brown pelicans live along the west coast of North America. They dive underwater to catch fish in their beaks. Brown pelicans keep their eggs warm by standing on the shells with their large, webbed feet. Salmon lay eggs with no shells at the bottom of freshwater streams. Salmon use their powerful fins to swim. They can even jump up small waterfalls! Picture: None Choices:  Answer index: 0	Subject: Science Description: iption: Two identical blocks are heated to different temperatures. The blocks are placed so that they touch each other. Heat can flow from one block to another but cannot escape from the blocks. Later, the temperature of each block is measured again. Which pair of temperatures is possible? Picture:   Choices: Answer index: 0
Subject: Science Description: iption: Two solid blocks are heated to the temperatures shown. The blocks are placed so they touch. Which diagram shows the direction heat will flow? Picture: None  Choices: Answer index: 0	Subject: Science Description: Select the plant. Picture: None  Choices: Answer index: 0
Subject: Science Description: iption: Use the data to answer the question below. Is the following statement about our solar system true or false? Of the four smallest planets, two are made mainly of gas.  Picture: Choices: [false, true,] Answer index: 0	Subject: Science Description: iption: Think about the magnetic force between the magnets in each pair. Which of the following statements is true? The images below show two pairs of magnets. The magnets in different pairs do not affect each other. All the magnets shown are made of the same material, but some of them are different sizes. Picture:  Choices: [The magnitude of the magnetic force is smaller in Pair 2., The magnitude of the magnetic force is the same in both pairs., The magnitude of the magnetic force is smaller in Pair 1.,] Answer index: 0

Table 15: Human evaluation problem set (part 4).

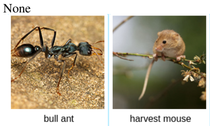
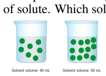
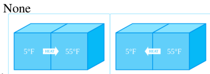
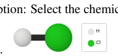
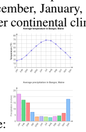
Subject: Science Description: iption: Think about the magnetic force between the magnets in each pair. Which of the following statements is true? The images below show two pairs of magnets. The magnets in different pairs do not affect each other. All the magnets shown are made of the same material. Picture:  Choices: [The magnetic force is stronger in Pair 2., The magnetic force is stronger in Pair 1., The strength of the magnetic force is the same in both pairs.,] Answer index: 0	Subject: Science Description: Select the gas. Picture: None  Choices: Answer index: 2
Subject: Science Description: Select the plant. Picture: None  Choices: Answer index: 0	Subject: Science Description: iption: Which property matches this object? Select the better answer.  Picture: Choices: [soft, smooth,] Answer index: 1
Subject: Science Description: iption: Select the animal that does not have a backbone. Hint: Insects, spiders, and worms do not have backbones. Picture: None  Choices: Answer index: 0	Subject: Science Description: iption: The diagram below is a model of two solutions. Each green ball represents one particle of solute. Which solution has a higher concentration of green particles?  Picture: Choices: [neither; their concentrations are the same, Solution A, Solution B,] Answer index: 2
Subject: Science Description: iption: Two solid blocks are at different temperatures. The blocks are touching. Which picture shows how heat will move? Picture: None  Choices: Answer index: 1	Subject: Science Description: Select the chemical formula for this molecule.  Picture: Choices: [H2C, HCl, HC, HCl2,] Answer index: 1
Subject: Science Description: iption: Which statement best describes the climate of Bangor? Hint: Summers in the Northern Hemisphere occur in June, July, and August. Winters in the Northern Hemisphere occur in December, January, and February. Bangor, Maine, is a city in the United States. It has a warm summer continental climate.  Picture: Choices: [Summers have higher temperatures and slightly more precipitation than winters., On average, On average,] Answer index: 1	Subject: Science Description: Select the temperature shown by this thermometer.  Picture: Choices: [13°F, 61°F, 56°F,] Answer index: 2

Table 16: Human evaluation problem set (part 5).

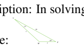
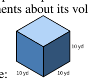
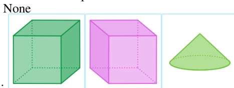
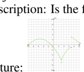
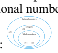
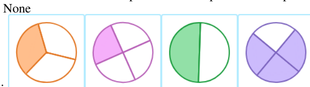
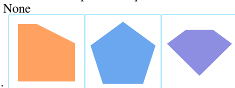
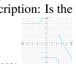
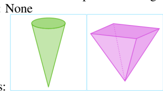
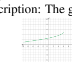
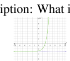
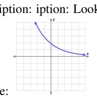
Subject: Math Description: iption: This table shows Jason's January budget. What could Jason do to balance his budget? Picture:  Choices: [increase income from shoveling snow to 40, $spend$15 less at Pizza Palace, spend only $40 at the arcade, spend $20 more on video games,] Answer index: 2	Subject: Math Description: In solving this triangle, which law must you use first? Picture:  Choices: [Law of Cosines, Law of Sines,] Answer index: 1
Subject: Math Description: Is this angle acute, right, obtuse, or straight? Picture:  Choices: [straight, obtuse, acute, right,] Answer index: 1	Subject: Math Description: iption: Look at this cube: If the side lengths are tripled, then which of the following statements about its volume will be true? Picture:  Choices: [The ratio of the new volume to the old volume will be 81:1., The ratio of the new volume to the old volume will be 1:8., The ratio of the new volume to the old volume will be 3:1., The ratio of the new volume to the old volume will be 27:1.,] Answer index: 3
Subject: Math Description: Which shape is a cone? Picture: None Choices:  Answer index: 2	Subject: Math Description: Is the function f(x) continuous on the open interval (3,7)? Picture:  Choices: [no, yes,] Answer index: 1
Subject: Math Description: iption: Use the diagram to help you answer the question below. Which of the following is a rational number but not an integer? Picture:  Choices: [–123, 83, 194, 6.53,] Answer index: 3	Subject: Math Description: Is this polygon a trapezoid? Picture:  Choices: [no, yes,] Answer index: 1
Subject: Math Description: Look at the colored part of each shape. Which shape shows one-third? Picture: None Choices:  Answer index: 0	Subject: Math Description: Which shape has 5 equal sides? Picture: None Choices:  Answer index: 1
Subject: Math Description: iption: Identify the cross section of this object. Assume objects are perpendicular if they appear so. Picture:  Choices: Answer index: 0	Subject: Math Description: Are there more circles or triangles? Picture:  Choices: [circles, triangles,] Answer index: 0
Subject: Math Description: iption: Look at this shape: Which image shows a reflection? Picture:  Choices: [C, A, B,] Answer index: 2	Subject: Math Description: Is the function f(x) continuous? Picture:  Choices: [no, yes,] Answer index: 0
Subject: Math Description: An ice cream sundae costs 1 dollar and 41 cents. Do you have enough money to buy it? Picture:  Choices: [yes, no,] Answer index: 0	Subject: Math Description: Which shape has a triangle as a face? Picture: None Choices:  Answer index: 1
Subject: Math Description: iption: Look at this figure: What is the shape of its bases? Picture:  Choices: [decagon, octagon, rectangle, circle,] Answer index: 2	Subject: Math Description: The graph below shows a function. Is its inverse also a function? Picture:  Choices: [yes, no,] Answer index: 0
Subject: Math Description: What is the range of this exponential function? Picture:  Choices: {y | y > −3} {y | y ≤ −3} {y | y ≥ −3} all real numbers {y | y < −3} Answer index: 0	Subject: Math Description: iption: Look at this graph: Is this relation a function? Picture:  Choices: [no, yes,] Answer index: 1

Table 17: Human evaluation problem set (part 6).

Subject	Grade	Skills
Science	grade-2	classify-fruits-and-vegetables-as-plant-parts, classify-matter-as-solid-liquid-or-gas, classify-matter-as-solid-or-liquid, classify-rocks-and-minerals-by-color-and-shape, compare-properties-of-materials, compare-properties-of-objects, compare-temperatures-on-thermometers, find-evidence-of-changes-to-earths-surface, identify-animals-with-and-without-backbones, identify-earth-s-land-features, identify-living-and-nonliving-things, identify-magnets-that-attract-or-repel, identify-mammals-birds-fish-reptiles-and-amphibians, identify-materials-in-objects, identify-plants-and-animals, identify-properties-of-an-object, identify-pushes-and-pulls, identify-solids-and-liquids, identify-solids-liquids-and-gases, identifying-mixtures, natural-resources, predict-heat-flow, read-a-thermometer
	grade-3	animal-adaptations-beaks-mouths-and-necks, animal-adaptations-feet-and-limbs, animal-adaptations-skins-and-body-coverings, classify-fruits-and-vegetables-as-plant-parts, classify-matter-as-solid-liquid-or-gas, classify-rocks-and-minerals-by-color-shape-and-texture, classify-rocks-as-igneous-sedimentary-or-metamorphic, compare-ancient-and-modern-organisms-use-observations-to-support-a-hypothesis, compare-properties-of-materials, compare-properties-of-objects, compare-strengths-of-magnetic-forces, compare-temperatures-on-thermometers, find-evidence-of-changes-to-earths-surface, how-do-balanced-and-unbalanced-forces-affect-motion, identify-earth-s-land-features, identify-ecosystems, identify-living-and-nonliving-things, identify-magnets-that-attract-or-repel, identify-mammals-birds-fish-reptiles-and-amphibians, identify-materials-in-objects, identify-minerals-using-properties, identify-plants-and-animals, identify-properties-of-an-object, identify-pushes-and-pulls, identify-rocks-using-properties, identify-roles-in-food-chains, identify-solids-liquids-and-gases, identify-vertebrates-and-invertebrates, interpret-food-webs, natural-resources, predict-heat-flow, predict-temperature-changes, read-a-thermometer, use-climate-data-to-make-predictions, use-data-to-describe-u-s-climates, use-data-to-describe-world-climates, weather-and-climate-around-the-world
	grade-4	animal-adaptations-beaks-mouths-and-necks, animal-adaptations-feet-and-limbs, animal-adaptations-skins-and-body-coverings, classify-fruits-and-vegetables-as-plant-parts, classify-rocks-as-igneous-sedimentary-or-metamorphic, compare-amplitudes-and-wavelengths-of-waves, compare-ancient-and-modern-organisms-use-observations-to-support-a-hypothesis, compare-properties-of-materials, compare-properties-of-objects, compare-strengths-of-magnetic-forces, compare-temperatures-on-thermometers, describe-classify-and-compare-kingdoms, evaluate-natural-energy-sources, how-do-balanced-and-unbalanced-forces-affect-motion, identify-and-classify-fossils, identify-and-sort-solids-liquids-and-gases, identify-common-and-scientific-names, identify-directions-of-forces, identify-earths-land-features-using-photographs, identify-earths-land-features-using-satellite-images, identify-ecosystems, identify-living-and-nonliving-things, identify-magnets-that-attract-or-repel, identify-mammals-birds-fish-reptiles-and-amphibians, identify-minerals-using-properties, identify-phases-of-the-moon, identify-rocks-using-properties, identify-roles-in-food-chains, identify-vertebrates-and-invertebrates, interpret-food-webs, origins-of-scientific-names, predict-heat-flow, predict-temperature-changes, read-a-thermometer, use-climate-data-to-make-predictions, use-data-to-describe-climates, use-evidence-to-classify-animals, use-evidence-to-classify-mammals-birds-fish-reptiles-and-amphibians, use-scientific-names-to-classify-organisms, weather-and-climate-around-the-world
	grade-5	animal-adaptations-beaks-mouths-and-necks, animal-adaptations-feet-and-limbs, animal-adaptations-skins-and-body-coverings, classify-elementary-substances-and-compounds-using-models, classify-fruits-and-vegetables-as-plant-parts, classify-rocks-as-igneous-sedimentary-or-metamorphic, compare-amplitudes-and-wavelengths-of-waves, compare-ancient-and-modern-organisms-use-observations-to-support-a-hypothesis, compare-magnitudes-of-magnetic-forces, compare-properties-of-objects, describe-classify-and-compare-kingdoms, evaluate-natural-energy-sources, flowering-plant-and-conifer-life-cycles, how-do-balanced-and-unbalanced-forces-affect-motion, identify-and-classify-fossils, identify-common-and-scientific-names, identify-directions-of-forces, identify-earths-land-features-using-photographs, identify-earths-land-features-using-satellite-images, identify-ecosystems, identify-magnets-that-attract-or-repel, identify-mammals-birds-fish-reptiles-and-amphibians, identify-phases-of-the-moon, identify-rocks-and-minerals, identify-roles-in-food-chains, identify-the-photosynthetic-organism, identify-vertebrates-and-invertebrates, match-chemical-formulas-to-ball-and-stick-models, moss-and-fern-life-cycles, origins-of-scientific-names, predict-heat-flow, predict-temperature-changes, use-data-to-describe-climates, use-evidence-to-classify-animals, use-evidence-to-classify-mammals-birds-fish-reptiles-and-amphibians, use-scientific-names-to-classify-organisms, weather-and-climate-around-the-world
	grade-6	analyze-data-to-compare-properties-of-planets, classify-elementary-substances-and-compounds-using-models, classify-rocks-as-igneous-sedimentary-or-metamorphic, classify-symbiotic-relationships, compare-ages-of-fossils-in-a-rock-sequence, compare-amplitudes-wavelengths-and-frequencies-of-waves, compare-concentrations-of-solutions, compare-magnitudes-of-magnetic-forces, compare-thermal-energy-transfers, describe-populations-communities-and-ecosystems, describe-tectonic-plate-boundaries-around-the-world, describe-the-effects-of-gene-mutations-on-organisms, diffusion-across-membranes, flowering-plant-and-conifer-life-cycles, identify-and-compare-air-masses, identify-common-and-scientific-names, identify-earths-land-features-using-photographs, identify-earths-land-features-using-satellite-images, identify-ecosystems, identify-elementary-substances-and-compounds-using-models, identify-how-particle-motion-affects-temperature-and-pressure, identify-phases-of-the-moon, identify-rocks-and-minerals, identify-the-photosynthetic-organism, match-chemical-formulas-to-ball-and-stick-models, moss-and-fern-life-cycles, origins-of-scientific-names, predict-heat-flow-and-temperature-changes, use-data-to-describe-climates, use-scientific-names-to-classify-organisms, weather-and-climate-around-the-world
	grade-7	analyze-data-to-compare-properties-of-planets, angiosperm-and-conifer-life-cycles, classify-elementary-substances-and-compounds-using-models, classify-rocks-as-igneous-sedimentary-or-metamorphic, classify-symbiotic-relationships, compare-ages-of-fossils-in-a-rock-sequence, compare-amplitudes-wavelengths-and-frequencies-of-waves, compare-concentrations-of-solutions, compare-magnitudes-of-magnetic-forces, compare-thermal-energy-transfers, describe-populations-communities-and-ecosystems, describe-tectonic-plate-boundaries-around-the-world, describe-the-effects-of-gene-mutations-on-organisms, diffusion-across-membranes, identify-and-compare-air-masses, identify-chemical-formulas-for-ball-and-stick-models, identify-common-and-scientific-names, identify-ecosystems, identify-how-particle-motion-affects-temperature-and-pressure, identify-phases-of-the-moon, identify-rocks-and-minerals, identify-the-photosynthetic-organism, moss-and-fern-life-cycles, origins-of-scientific-names, predict-heat-flow-and-temperature-changes, use-data-to-describe-climates, use-scientific-names-to-classify-organisms
	grade-8	analyze-data-to-compare-properties-of-planets, angiosperm-and-conifer-life-cycles, classify-elementary-substances-and-compounds-using-models, classify-symbiotic-relationships, compare-ages-of-fossils-in-a-rock-sequence, compare-amplitudes-wavelengths-and-frequencies-of-waves, compare-concentrations-of-solutions, compare-magnitudes-of-magnetic-forces, compare-thermal-energy-transfers, describe-populations-communities-and-ecosystems, describe-tectonic-plate-boundaries-around-the-world, describe-the-effects-of-gene-mutations-on-organisms, diffusion-across-membranes, identify-and-compare-air-masses, identify-chemical-formulas-for-ball-and-stick-models, identify-common-and-scientific-names, identify-ecosystems, identify-how-particle-motion-affects-temperature-and-pressure, identify-phases-of-the-moon, identify-rocks-and-minerals, identify-the-photosynthetic-organism, moss-and-fern-life-cycles, origins-of-scientific-names, predict-heat-flow-and-temperature-changes, use-data-to-describe-climates, use-punnett-squares-to-calculate-probabilities-of-offspring-types, use-punnett-squares-to-calculate-ratios-of-offspring-types, use-scientific-names-to-classify-organisms
Technology	-	cables, font, icons, logo, parts, peripherals, photo, web, others
Engineering	grade-5	identify-laboratory-tools
	grade-6	evaluate-tests-of-engineering-design-solutions, identify-control-and-experimental-groups, identify-independent-and-dependent-variables, identify-laboratory-tools, identify-the-experimental-question, laboratory-safety-equipment
	grade-7	evaluate-tests-of-engineering-design-solutions, identify-control-and-experimental-groups, identify-independent-and-dependent-variables, identify-laboratory-tools, identify-the-experimental-question, laboratory-safety-equipment
	grade-8	identify-control-and-experimental-groups, identify-laboratory-tools, identify-the-experimental-question, laboratory-safety-equipment

Table 18: Full skill summary (part 1), including science, technology and engineering skills.

Subject	Grade	Skills
	algebra-1	compare-linear-functions-graphs-and-equations, compare-linear-functions-tables-graphs-and-equations, describe-linear-and-exponential-growth-and-decay, domain-and-range-of-absolute-value-functions-graphs, domain-and-range-of-exponential-functions-graphs, domain-and-range-of-square-root-functions-graphs, factor-quadratics-using-algebra-tiles, identify-direct-variation-and-inverse-variation, identify-functions, identify-functions-vertical-line-test, identify-linear-and-exponential-functions-from-graphs, identify-linear-and-exponential-functions-from-tables, identify-linear-functions-from-graphs-and-equations, identify-linear-functions-from-tables, identify-linear-quadratic-and-exponential-functions-from-graphs, identify-linear-quadratic-and-exponential-functions-from-tables, identify-proportional-relationships, interpret-a-scatter-plot, interpret-the-slope-and-y-intercept-of-a-linear-function, linear-functions-over-unit-intervals, match-exponential-functions-and-graphs-ii, model-and-solve-linear-equations-using-algebra-tiles, multiply-two-binomials-using-algebra-tiles, perimeter-and-area-changes-in-scale, perimeter-area-and-volume-changes-in-scale, special-right-triangles, surface-area-and-volume-changes-in-scale, write-compound-inequalities-from-graphs
	algebra-2	classify-variation, describe-linear-and-exponential-growth-and-decay, domain-and-range-of-absolute-value-functions-graphs, domain-and-range-of-exponential-and-logarithmic-functions, domain-and-range-of-radical-functions, factor-quadratics-using-algebra-tiles, find-inverse-functions-and-relations, find-solutions-using-a-table, graphs-of-angles, identify-the-direction-a-parabola-opens, linear-functions-over-unit-intervals, match-exponential-functions-and-graphs, outliers-in-scatter-plots, solve-a-triangle
	calculus	describe-linear-and-exponential-growth-and-decay, determine-continuity-on-an-interval-using-graphs, determine-continuity-using-graphs, determine-one-sided-continuity-using-graphs, domain-and-range, domain-and-range-of-exponential-and-logarithmic-functions, find-inverse-functions-and-relations, find-limits-at-vertical-asymptotes-using-graphs, identify-functions, identify-graphs-of-continuous-functions

Table 19: Full skill summary (part 2), including math skills for algebra-{1,2} and calculus.

Subject	Grade	Skills
Math	grade-1	addition-sentences-up-to-10-what-does-the-model-show, addition-sentences-up-to-10-which-model-matches, addition-sentences-using-number-lines-sums-up-to-20, am-or-pm, certain-probable-unlikely-and-impossible, compare-clocks, compare-money-amounts, compare-objects-length-and-height, compare-sides-and-corners, compare-size-weight-and-capacity, compare-vertices-edges-and-faces, comparing-review, count-sides-and-corners, count-to-fill-a-ten-frame, cubes-and-rectangular-prisms, equal-sides, estimate-to-the-nearest-ten, even-or-odd, find-the-next-shape-in-a-growing-pattern, find-the-next-shape-in-a-pattern, flip-turn-and-slide, holds-more-or-less, identify-faces-of-three-dimensional-shapes, identify-fourths, identify-halves, identify-halves-and-fourths, identify-halves-thirds-and-fourths, identify-shapes-traced-from-solids, identify-thirds, interpret-bar-graphs-ii, light-and-heavy, match-analog-and-digital-clocks, match-analog-clocks-and-times, match-digital-clocks-and-times, more-less-and-equally-likely, name-the-three-dimensional-shape, name-the-two-dimensional-shape, names-and-values-of-all-coins, names-and-values-of-common-coins, open-and-closed-shapes, ordinal-numbers, purchases-do-you-have-enough-money, read-a-calendar, read-a-calendar-ii, rhombuses, select-three-dimensional-shapes, select-two-dimensional-shapes, shapes-of-everyday-objects, simple-fractions-what-fraction-does-the-shape-show, square-corners, subtraction-sentences-up-to-10-which-model-matches, subtraction-sentences-using-number-lines-up-to-10, subtraction-sentences-using-number-lines-up-to-20, symmetry, time-and-clocks-word-problems, times-of-everyday-events, two-dimensional-and-three-dimensional-shapes, which-bar-graph-is-correct, which-picture-graph-is-correct, which-table-is-correct, which-tally-chart-is-correct, wide-and-narrow
	grade-2	am-or-pm, certain-probable-unlikely-and-impossible, choose-the-appropriate-measuring-tool, compare-clocks, compare-sides-and-vertices, compare-vertices-edges-and-faces, correct-amount-of-change, cubes, equal-sides, equivalent-amounts-of-money-up-to-1-dollar, estimate-to-the-nearest-ten, even-or-odd, find-the-next-shape-in-a-growing-pattern, find-the-next-shape-in-a-repeating-pattern, flip-turn-and-slide, fractions-of-a-group, fractions-of-a-whole-modeling-word-problems, greatest-and-least-word-problems-up-to-100, greatest-and-least-word-problems-up-to-1000, how-much-more-to-make-a-dollar, identify-faces-of-three-dimensional-shapes, identify-fourths, identify-halves, identify-halves-thirds-and-fourths, identify-lines-of-symmetry, identify-multiplication-sentences-for-equal-groups, identify-repeated-addition-in-arrays-sums-to-10, identify-repeated-addition-in-arrays-sums-to-25, identify-shapes-traced-from-solids, identify-the-fraction, identify-thirds, interpret-bar-graphs-ii, interpret-tally-charts, match-addition-sentences-and-models-sums-to-10, match-analog-and-digital-clocks, match-analog-clocks-and-times, match-digital-clocks-and-times, more-less-and-equally-likely, name-the-three-dimensional-shape, name-the-two-dimensional-shape, names-and-values-of-all-coins, names-and-values-of-common-coins, ordinal-numbers-up-to-10th, place-value-models-up-to-hundreds, place-value-tens-and-ones, place-value-up-to-hundreds, place-value-up-to-thousands, purchases-do-you-have-enough-money-up-to-1-dollar, purchases-do-you-have-enough-money-up-to-5-dollars, read-a-calendar, read-a-calendar-ii, read-a-thermometer, select-figures-with-a-given-area, select-three-dimensional-shapes, shapes-of-everyday-objects, skip-counting-stories, symmetry, which-bar-graph-is-correct, which-picture-shows-more-up-to-5-dollars, which-shape-illustrates-the-fraction, which-table-is-correct, which-tally-chart-is-correct, write-subtraction-sentences-to-describe-pictures-up-to-18, write-subtraction-sentences-to-describe-pictures-up-to-two-digits
	grade-3	acute-obtuse-and-right-triangles, am-or-pm, angles-greater-than-less-than-or-equal-to-a-right-angle, certain-probable-unlikely-and-impossible, choose-the-appropriate-measuring-tool, compare-area-and-perimeter-of-two-figures, compare-fractions-in-recipes, compare-fractions-using-models, compare-fractions-using-number-lines, coordinate-planes-as-maps, correct-amount-of-change, division-input-output-tables-find-the-rule, find-the-next-shape-in-a-pattern, fractions-of-a-group-denominators-2-3-4-6-8, fractions-of-a-group-unit-fractions, identify-equivalent-fractions-on-number-lines, identify-faces-of-three-dimensional-shapes, identify-multiplication-expressions-for-arrays, identify-multiplication-expressions-for-equal-groups, identify-parallelograms, identify-rhombuses, identify-three-dimensional-shapes, identify-trapezoids, identify-two-dimensional-shapes, identify-unit-fractions-on-number-lines, interpret-line-graphs, is-it-a-polygon, lines-line-segments-and-rays, match-analog-and-digital-clocks, match-clocks-and-times, match-fractions-to-models-halves-thirds-and-fourths, match-mixed-numbers-to-models, multiplication-input-output-tables-find-the-rule, open-and-closed-shapes, parallel-perpendicular-and-intersecting-lines, parallel-sides-in-quadrilaterals, purchases-do-you-have-enough-money-up-to-10-dollars, read-a-calendar, read-a-thermometer, reading-schedules, reflection-rotation-and-translation, scalene-isosceles-and-equilateral-triangles, select-figures-with-a-given-area, select-fractions-equivalent-to-whole-numbers-using-models, shapes-of-everyday-objects, symmetry, which-picture-shows-more
	grade-4	acute-obtuse-and-right-triangles, acute-right-obtuse-and-straight-angles, angles-as-fractions-of-a-circle, angles-of-90-180-270-and-360-degrees, classify-triangles, compare-area-and-perimeter-of-two-figures, compare-decimals-using-models, compare-fractions-in-recipes, compare-fractions-using-models, compare-fractions-with-like-numerators-or-denominators-using-models, decompose-fractions-into-unit-fractions-using-models, elapsed-time, estimate-angle-measurements, find-the-next-shape-in-a-pattern, fractions-of-a-whole-word-problems, identify-equivalent-fractions-using-number-lines, identify-faces-of-three-dimensional-figures, identify-lines-of-symmetry, identify-parallel-perpendicular-and-intersecting-lines, identify-parallelograms, identify-rhombuses, identify-three-dimensional-figures, identify-trapezoids, interpret-bar-graphs, interpret-stem-and-leaf-plots, is-it-a-polygon, measure-angles-with-a-protractor, multiplication-input-output-tables-find-the-rule, multiply-fractions-by-whole-numbers-using-models, multiply-unit-fractions-by-whole-numbers-using-models, nets-of-three-dimensional-figures, parallel-perpendicular-and-intersecting-lines, parallel-sides-in-quadrilaterals, points-lines-line-segments-rays-and-angles, properties-of-three-dimensional-figures, rotational-symmetry, scalene-isosceles-and-equilateral-triangles, sides-and-angles-of-quadrilaterals, transportation-schedules, what-decimal-number-is-illustrated
	grade-5	acute-obtuse-and-right-triangles, adjust-a-budget, angles-of-90-180-270-and-360-degrees, classify-triangles, compare-decimals-using-grids, compare-fractions-and-mixed-numbers, compare-patterns, fractions-of-a-whole-word-problems, identify-parallelograms, identify-rhombuses, identify-three-dimensional-figures, identify-trapezoids, interpret-bar-graphs, is-it-a-polygon, line-symmetry, mean-find-the-missing-number, median-find-the-missing-number, multiplication-input-output-tables-find-the-rule, multiply-unit-fractions-by-whole-numbers-using-models, multiplying-fractions-by-whole-numbers-choose-the-model, nets-of-three-dimensional-figures, parallel-perpendicular-and-intersecting-lines, parallel-sides-in-quadrilaterals, parts-of-a-circle, points-lines-line-segments-rays-and-angles, range-find-the-missing-number, reflection-rotation-and-translation, regular-and-irregular-polygons, rotational-symmetry, rotational-symmetry-amount-of-rotation, scalene-isosceles-and-equilateral-triangles, three-dimensional-figures-viewed-from-different-perspectives, types-of-angles, understanding-probability
	grade-6	absolute-value-and-integers-word-problems, changes-in-mean-median-mode-and-range, classify-rational-numbers-using-a-diagram, classify-triangles, compare-and-order-rational-numbers-using-number-lines, compare-area-and-perimeter-of-two-figures, compare-checking-accounts, front-side-and-top-view, identify-complementary-supplementary-vertical-adjacent-and-congruent-angles, identify-equivalent-expressions-using-strip-models, identify-polyhedra, identify-trapezoids, interpret-bar-graphs, interpret-double-bar-graphs, interpret-graphs-of-proportional-relationships, interpret-histograms, line-symmetry, mean-median-mode-and-range-find-the-missing-number, model-and-solve-equations-using-algebra-tiles, nets-of-three-dimensional-figures, occupations-education-and-income, quadrants, rational-numbers-find-the-sign, reflection-rotation-and-translation, rotational-symmetry, rotational-symmetry-amount-of-rotation, similar-and-congruent-figures, understanding-area-of-a-triangle, understanding-area-of-trapezoids, understanding-percents-strip-models, which-figure-is-being-described, which-is-the-better-coupon, which-model-represents-the-ratio
	grade-7	apply-addition-and-subtraction-rules, apply-multiplication-and-division-rules, bases-of-three-dimensional-figures, changes-in-mean-median-mode-and-range, classify-quadrilaterals, classify-rational-numbers-using-a-diagram, compare-and-order-integers, cross-sections-of-three-dimensional-figures, describe-a-sequence-of-transformations, front-side-and-top-view, identify-alternate-interior-and-alternate-exterior-angles, identify-complementary-supplementary-vertical-and-adjacent-angles, identify-equivalent-linear-expressions-using-algebra-tiles, identify-linear-and-nonlinear-functions, identify-reflections-rotations-and-translations, identify-trapezoids, identify-trends-with-scatter-plots, interpret-circle-graphs, interpret-graphs-of-proportional-relationships, line-symmetry, make-predictions-with-scatter-plots, mean-median-mode-and-range-find-the-missing-number, model-and-solve-equations-using-algebra-tiles, nets-of-three-dimensional-figures, parallel-perpendicular-and-intersecting-lines, parts-of-a-circle, perimeter-and-area-changes-in-scale, rational-numbers-find-the-sign, rotational-symmetry, rotational-symmetry-amount-of-rotation, similar-and-congruent-figures, simplify-expressions-by-combining-like-terms-with-algebra-tiles, transversals-of-parallel-lines-name-angle-pairs, which-is-the-better-coupon
	grade-8	angle-angle-criterion-for-similar-triangles, apply-addition-and-subtraction-rules, apply-addition-subtraction-multiplication-and-division-rules, apply-multiplication-and-division-rules, base-plans, changes-in-mean-median-mode-and-range, classify-quadrilaterals, compare-and-order-integers, compare-linear-functions-graphs-and-equations, compare-linear-functions-tables-graphs-and-equations, congruent-triangles-sss-sas-and-asa, describe-a-sequence-of-transformations, front-side-and-top-view, identify-alternate-interior-and-alternate-exterior-angles, identify-complementary-supplementary-vertical-adjacent-and-congruent-angles, identify-congruent-figures, identify-functions-graphs, identify-linear-and-nonlinear-functions-graphs-and-equations, identify-linear-and-nonlinear-functions-tables, identify-lines-of-best-fit, identify-reflections-rotations-and-translations, identify-similar-triangles, identify-trapezoids, identify-trends-with-scatter-plots, interpret-graphs-of-proportional-relationships, interpret-the-slope-and-y-intercept-of-a-linear-function, irrational-numbers-on-number-lines, line-symmetry, make-predictions-with-scatter-plots, mean-median-mode-and-range-find-the-missing-number, model-and-solve-equations-using-algebra-tiles, multiply-polynomials-using-algebra-tiles, nets-of-three-dimensional-figures, parts-of-a-circle, parts-of-three-dimensional-figures, perimeter-and-area-changes-in-scale, quadrants-and-axes, rotational-symmetry, rotational-symmetry-amount-of-rotation, similar-and-congruent-figures, transversals-of-parallel-lines-name-angle-pairs
	kindergarten	addition-sentences-up-to-10-what-does-the-model-show, addition-sentences-up-to-10-which-model-matches, addition-sentences-up-to-5-what-does-the-model-show, addition-sentences-up-to-5-which-model-matches, am-or-pm, are-there-enough, circles, classify-shapes-by-color, coin-names-penny-through-quarter, compare-sides-and-corners, compare-size-weight-and-capacity, compare-two-groups-of-coins-pennies-through-dimes, cones, count-corners, count-cubes-up-to-10, count-cubes-up-to-5, count-dots-0-to-5, count-dots-up-to-10, count-money-pennies-and-nickels, count-money-pennies-through-dimes, count-on-ten-frames-up-to-10, count-pictures-up-to-10, count-pictures-up-to-3, count-pictures-up-to-5, count-scattered-shapes-up-to-10, count-scattered-shapes-up-to-5, count-shapes-in-rings-up-to-10, count-shapes-in-rows-up-to-10, count-shapes-in-rows-up-to-5, count-shapes-up-to-3, count-sides, count-sides-and-corners, count-to-100, count-to-fill-a-ten-frame, cubes, curved-parts, cylinders, different, equal-sides, fewer-and-more-compare-by-counting, fewer-and-more-compare-by-matching, fewer-and-more-compare-in-a-mixed-group, fewer-and-more-up-to-20, fewer-more-and-same, flat-and-solid-shapes, hexagons, holds-more-or-less, identify-halves-thirds-fourths, identify-pictures-with-symmetry, identify-shapes-traced-from-solids, inside-and-outside, introduction-to-symmetry, light-and-heavy, match-analog-and-digital-clocks, match-analog-clocks-and-times, match-digital-clocks-and-times, more-or-less-likely, name-the-three-dimensional-shape, name-the-two-dimensional-shape, one-less-with-pictures-up-to-10, one-less-with-pictures-up-to-5, one-more-and-one-less-with-pictures-up-to-10, one-more-with-pictures-up-to-10, one-more-with-pictures-up-to-5, ordinal-numbers-up-to-fifth, ordinal-numbers-up-to-tenth, rectangles, represent-numbers-up-to-10, represent-numbers-up-to-20, represent-numbers-with-pictures-up-to-3, represent-numbers-with-pictures-up-to-5, represent-numbers-with-shapes-up-to-3, represent-numbers-with-shapes-up-to-5, select-three-dimensional-shapes, select-two-dimensional-shapes, shapes-of-everyday-objects, spheres, square-corners, squares, subtraction-sentences-up-to-10-what-does-the-model-show, subtraction-sentences-up-to-10-which-model-matches, subtraction-sentences-up-to-5-what-does-the-model-show, subtraction-sentences-up-to-5-which-model-matches, take-apart-10-words, take-apart-numbers-up-to-10-words, take-apart-numbers-up-to-5-words, tall-and-short, times-of-everyday-events, triangles, wide-and-narrow
	pre-k	addition-sentences-up-to-10-what-does-the-model-show, addition-sentences-up-to-10-which-model-matches, addition-sentences-up-to-5-what-does-the-model-show, addition-sentences-up-to-5-which-model-matches, are-there-enough, circles, circles-squares-and-triangles, circles-squares-triangles-and-rectangles, classify-shapes-by-color, compare-size-weight-and-capacity, cones, count-corners, count-cubes-up-to-10, count-cubes-up-to-5, count-dots-up-to-10, count-dots-up-to-3, count-dots-up-to-5, count-on-ten-frames-up-to-10, count-on-ten-frames-up-to-3, count-on-ten-frames-up-to-5, count-pennies, count-pictures-up-to-10, count-pictures-up-to-3, count-pictures-up-to-5, count-scattered-shapes-up-to-10, count-scattered-shapes-up-to-5, count-shapes-in-rings-up-to-10, count-shapes-in-rows-up-to-10, count-shapes-in-rows-up-to-5, count-shapes-up-to-3, count-sides, count-sides-and-corners, cubes, cylinders, different, dimes-and-quarters, fewer, fewer-and-more-compare-by-counting, fewer-and-more-compare-by-matching, fewer-and-more-compare-in-a-mixed-group, fewer-more-and-same, flat-and-solid-shapes, holds-more-or-less, identify-shapes-traced-from-solids, inside-and-outside, light-and-heavy, more, name-the-shape, name-the-solid-shape, one-less-with-pictures-up-to-10, one-less-with-pictures-up-to-5, one-more-with-pictures-up-to-10, one-more-with-pictures-up-to-5, ordinal-numbers-up-to-fifth, ordinal-numbers-up-to-tenth, pennies-and-nickels, pennies-nickels-dimes-and-quarters, rectangles, represent-numbers-up-to-10, represent-numbers-up-to-20, represent-numbers-with-pictures-up-to-3, represent-numbers-with-pictures-up-to-5, represent-numbers-with-shapes-up-to-3, represent-numbers-with-shapes-up-to-5, select-solid-shapes, shapes-of-everyday-objects, spheres, squares, subtraction-sentences-up-to-10-which-model-matches, subtraction-sentences-up-to-5-which-model-matches, tall-and-short, tally-marks-up-to-10, triangles, what-comes-next, wide-and-narrow
	precalculus	determine-continuity-on-an-interval-using-graphs, determine-continuity-using-graphs, determine-one-sided-continuity-using-graphs, find-limits-at-vertical-asymptotes-using-graphs, identify-graphs-of-continuous-functions, outliers-in-scatter-plots, solve-a-triangle

Table 20: Full skill summary (part 3), including math skills for grade 1-8 and pre-k, kindergarten and pre-calculus.

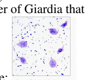
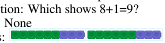
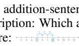
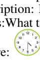
Subject: Engineer Skill: evaluate-tests-of-engineering-design-solutions Description: Which of the following could Eliana's test show?Eliana was taking part in her school's engineering competition. To win the competition, she needed to build the popsicle-stick bridge that would hold the most weight. She could use only 200 popsicle sticks. She had two different design ideas. She had to pick one of the designs to use in the competition. To test which design was strongest, Eliana built two prototypes, each with 200 popsicle sticks. She then added 1 kg weights to each prototype until one of them broke. The passage below describes how the engineering-design process was used to test a solution to a problem. Read the passage. Then answer the question below. Picture:  Choices: [how much weight a bridge built with 300 popsicle sticks could hold, which design could hold more weight,] Answer index: 1	Subject: Engineer Skill: identify-control-and-experimental-groups Description: In this experiment, which were part of a control group?The passage below describes an experiment. Madelyn has a bubble machine and wants to know how to make the bubbles last longer. She read that bubbles burst when the liquid that makes up the bubbles evaporates. Madelyn knew that when liquids are warmer, they evaporate faster. So, she wondered if she could make her bubbles last longer by cooling the bubble solution. Madelyn cooled six bottles of bubble solution to 30°F below room temperature. She left another six bottles of bubble solution at room temperature. Then, she measured how long bubbles made from the solution in each bottle lasted. Picture:  Choices: [the bottles that were cooled down, the bottles that were at room temperature,] Answer index: 1
Subject: Engineer Skill: identify-independent-and-dependent-variables Description: Hint: An independent variable is a variable whose effect you are investigating. A dependent variable is a variable that you measure.Which of the following was a dependent variable in this experiment? The passage below describes an experiment. Read the passage and think about the variables that are described. Giardia is a microscopic parasite that lives in water and can infect humans. Dr. Roth designed a drinking straw that contained a filter to remove Giardia from water. Dr. Roth wanted to know if a longer filtering straw would remove more Giardia. Dr. Roth made six filtering straws: three that were five inches long and three that were ten inches long. She prepared six one-liter batches of water, each containing 10,000 Giardia. Then, Dr. Roth passed one batch of water through each straw. After each batch passed through the straw, she used a microscope to count the number of Giardia that remained in a small sample of the water. Picture:  Choices: [the number of Giardia that remained in the water, the length of the filtering straw,] Answer index: 0	Subject: Engineer Skill: identify-laboratory-tools Description: Select the round-bottom flask. Picture: None Choices:  Answer index: 1
Subject: Engineer Skill: identify-the-experimental-question Description: Identify the question that Jeffrey's experiment can best answer.The passage below describes an experiment. Read the passage and then follow the instructions below. Jeffrey mixed bacteria into a nutrient-rich liquid where the bacteria could grow. He poured four ounces of the mixture into each of ten glass flasks. In five of the ten flasks, he also added one teaspoon of cinnamon. He allowed the bacteria in the flasks to grow overnight in a 37°C room. Then, Jeffrey used a microscope to count the number of bacteria in a small sample from each flask. He compared the amount of bacteria in the liquid with cinnamon to the amount of bacteria in the liquid without cinnamon. Picture:  Choices: [Do more bacteria grow in liquid with cinnamon than in liquid without cinnamon?, Does temperature affect how much bacteria can grow in liquid?,] Answer index: 0	Subject: Engineer Skill: laboratory-safety-equipment Description: Select the apron. Picture: None Choices:  Answer index: 3
Subject: Math Skill: absolute-value-and-integers-word-problems Description: Debbie likes watching the show Engineering Marvels. In last night's episode, the engineering team visited a tall skyscraper and a deep mine. A banner at the bottom of the screen showed the elevation of each location the team visited.Which location is closer to sea level? Picture:  Location: Top of the skyscraper, Elevation (m): 275; Location: Bottom of the mine, Elevation (m): −260 Choices: [bottom of the mine, top of the skyscraper,] Answer index: 0	Subject: Math Skill: acute-obtuse-and-right-triangles Description: What kind of triangle is this? Picture:  Choices: [obtuse, right, acute,] Answer index: 0
Subject: Math Skill: acute-right-obtuse-and-straight-angles Description: Is this angle acute, right, obtuse, or straight? Picture:  Choices: [straight, obtuse, acute, right,] Answer index: 1	Subject: Math Skill: addition-sentences-up-to-10-what-does-the-model-show Description: Which addition sentence does the picture show? Picture:  Choices: [4+3=7, 5+2=7,] Answer index: 0
Subject: Math Skill: addition-sentences-up-to-10-which-model-matches Description: Which shows 8+1=9? Picture: None Choices:  Answer index: 0	Subject: Math Skill: addition-sentences-up-to-5-what-does-the-model-show Description: Which addition sentence does the picture show? Picture:  Choices: [4+1=5, 3+1=4,] Answer index: 0
Subject: Math Skill: addition-sentences-up-to-5-which-model-matches Description: Which shows 2+1=3? Picture: None Choices:  Answer index: 0	Subject: Math Skill: addition-sentences-using-number-lines-sums-up-to-20 Description: Which addition sentence does this model show? Picture:  Choices: [3+3=6, 5+6=11, 5+4=9, 5+3=8,] Answer index: 3
Subject: Math Skill: adjust-a-budget Description: This table shows Angie's February budget.What could Angie do to balance her budget? Picture:  Angie's February budget — Income: Decorating custom cookies: $35; Working at Dough Good bakery: $215; Gift from Mom: $25. Expenses: Baking kit: $55; Cooking classes: $195; Mall shopping: $80 Choices: [spend only $60 at the mall, and teach a baking class for $30, decorate more custom cookies to earn another $35, and spend only $60 at the mall, spend $20 more on the baking kit, and teach a baking class for $30, decorate more custom cookies to earn another $35, and spend $20 more on the baking kit,] Answer index: 1	Subject: Math Skill: am-or-pm Description: Farmer Keenan is getting up to go milk his cows. It is just before sunrise. His watch shows:What time is it? Picture:  Choices: [4:30 P.M., 4:30 A.M.,] Answer index: 1
Subject: Math Skill: angle-angle-criterion-for-similar-triangles Description: FGH and JKL are shown below.Which statement is true? Picture:  Choices: [FGH is similar to JKL., FGH is not similar to JKL., There is not enough information to determine whether the triangles are similar.,] Answer index: 2	Subject: Math Skill: angles-as-fractions-of-a-circle Description: What fraction of the circle does this angle cut out? Picture:  Choices: [1/4, 3/4, 1 whole, 1/2,] Answer index: 0

Table 21: Question examples for each skill (part 1).

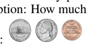
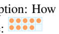
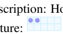
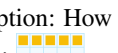
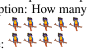
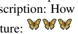
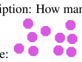
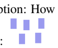
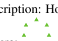
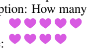
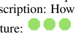
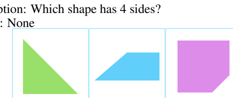
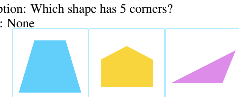
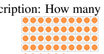
Subject: Math Skill: count-money-pennies-and-nickels Description: How much money is there? Picture:  Choices: [6¢, 11¢, 16¢,] Answer index: 1	Subject: Math Skill: count-money-pennies-through-dimes Description: How much money is there? Picture:  Choices: [18¢, 16¢, 19¢,] Answer index: 0
Subject: Math Skill: count-on-ten-frames-up-to-10 Description: How many dots are on the frame? Picture:  Choices: [4, 9, 2, 8, 1, 7, 5, 10, 6, 3,] Answer index: 1	Subject: Math Skill: count-on-ten-frames-up-to-3 Description: How many dots are on the frame? Picture:  Choices: [3, 2, 1,] Answer index: 1
Subject: Math Skill: count-on-ten-frames-up-to-5 Description: How many squares are on the frame? Picture:  Choices: [4, 5, 1, 2, 3,] Answer index: 1	Subject: Math Skill: count-pennies Description: How much money is there? Picture:  Choices: [7¢, 6¢, 8¢,] Answer index: 2
Subject: Math Skill: count-pictures-up-to-10 Description: How many parrots are there? Picture:  Choices: [1, 4, 3, 6, 9, 5, 7, 10, 8, 2,] Answer index: 4	Subject: Math Skill: count-pictures-up-to-3 Description: How many butterflies are there? Picture:  Choices: [2, 1, 3,] Answer index: 2
Subject: Math Skill: count-pictures-up-to-5 Description: How many snowmen are there? Picture:  Choices: [2, 5, 1, 4, 3,] Answer index: 4	Subject: Math Skill: count-scattered-shapes-up-to-10 Description: How many shapes are there? Picture:  Choices: [2, 3, 8, 1, 9, 10, 4, 6, 7, 5,] Answer index: 5
Subject: Math Skill: count-scattered-shapes-up-to-5 Description: How many rectangles are there? Picture:  Choices: [2, 4, 5, 3, 1,] Answer index: 2	Subject: Math Skill: count-shapes-in-rings-up-to-10 Description: How many triangles are there? Picture:  Choices: [9, 3, 5, 2, 7, 6, 8, 1, 4, 10,] Answer index: 4
Subject: Math Skill: count-shapes-in-rows-up-to-10 Description: How many hearts are there? Picture:  Choices: [5, 1, 7, 9, 8, 10, 3, 4, 2, 6,] Answer index: 3	Subject: Math Skill: count-shapes-in-rows-up-to-5 Description: How many shapes are there? Picture:  Choices: [3, 2, 1, 4, 5,] Answer index: 0
Subject: Math Skill: count-shapes-up-to-3 Description: How many triangles are there? Picture:  Choices: [2, 1, 3,] Answer index: 0	Subject: Math Skill: count-sides Description: Which shape has 4 sides? Picture: None Choices:  Answer index: 1
Subject: Math Skill: count-sides-and-corners Description: Which shape has 5 corners? Picture: None Choices:  Answer index: 1	Subject: Math Skill: count-to-100 Description: How many dots are there? Picture:  Choices: [46, 49, 44,] Answer index: 0

Table 22: Question examples for each skill (part 2).

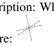
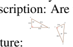
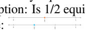
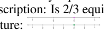
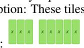
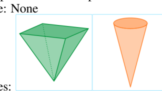
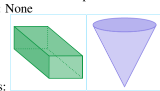
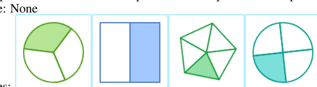
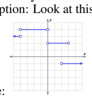
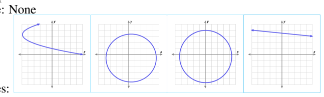
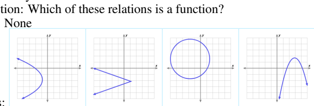
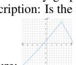
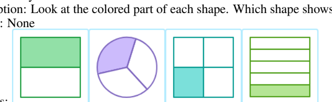
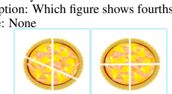
Subject: Math Skill: identify-alternate-interior-and-alternate-exterior-angles Description: line{RT} and line{UW} are parallel lines.Which angles are alternate interior angles? Picture:  Choices: [angle{TSV} and angle{UVS}, angle{TSV} and angle{TSQ}, angle{TSV} and angle{RSV}, angle{TSV} and angle{WVS},] Answer index: 0	Subject: Math Skill: identify-complementary-supplementary-vertical-adjacent-and-congruent-angles Description: Which angle is vertical to angle{3}? Picture:  Choices: [angle{6}, angle{5}, angle{4}, angle{2},] Answer index: 0
Subject: Math Skill: identify-complementary-supplementary-vertical-and-adjacent-angles Description: Which angles are adjacent to each other? Picture:  Choices: [angle{1}angle{3} and angle{7}, angle{1}angle{5} and angle{1}angle{4}, angle{8} and angle{4}, angle{1}angle{0} and angle{4},] Answer index: 1	Subject: Math Skill: identify-congruent-figures Description: Are these shapes congruent? Picture:  Choices: [no, yes,] Answer index: 1
Subject: Math Skill: identify-direct-variation-and-inverse-variation Description: Which equation shows direct variation? Picture: None $y=\frac{x}{-34}$ $y=\frac{x}{-34}$ Choices: Answer index: 1	Subject: Math Skill: identify-equivalent-expressions-using-strip-models Description: This model represents the expression x+x+1+1.Which expression is equivalent to x+x+1+1? Picture:  Choices: [4x, 2x+3, 3x+1, 2x+2,] Answer index: 3
Subject: Math Skill: identify-equivalent-fractions-on-number-lines Description: Is 1/2 equivalent to 1/3 ? Picture:  Choices: [no, yes,] Answer index: 0	Subject: Math Skill: identify-equivalent-fractions-using-number-lines Description: Is 2/3 equivalent to 4/6 ? Picture:  Choices: [yes, no,] Answer index: 0
Subject: Math Skill: identify-equivalent-linear-expressions-using-algebra-tiles Description: These tiles represent the expression 3x+5x.Which expression is equivalent to 3x+5x? Picture:  Choices: [x+8, 2x, 8x, 8x+2,] Answer index: 2	Subject: Math Skill: identify-faces-of-three-dimensional-figures Description: Which shape has a circle as a face? Picture: None  Choices: Answer index: 1
Subject: Math Skill: identify-faces-of-three-dimensional-shapes Description: Which shape has a circle as a face? Picture: None  Choices: Answer index: 1	Subject: Math Skill: identify-fourths Description: Look at the colored part of each shape. Which shape shows one-fourth? Picture: None  Choices: Answer index: 3
Subject: Math Skill: identify-functions Description: Look at this graph:Is this relation a function?  Picture: Choices: [yes, no,] Answer index: 1	Subject: Math Skill: identify-functions-graphs Description: Which of these relations is a function? Picture: None  Choices: Answer index: 3
Subject: Math Skill: identify-functions-vertical-line-test Description: Which of these relations is a function? Picture: None  Choices: Answer index: 3	Subject: Math Skill: identify-graphs-of-continuous-functions Description: Is the function f(x) continuous?  Picture: Choices: [yes, no,] Answer index: 0
Subject: Math Skill: identify-halves Description: Look at the colored part of each shape. Which shape shows one-half? Picture: None  Choices: Answer index: 0	Subject: Math Skill: identify-halves-and-fourths Description: Which figure shows fourths? Picture: None  Choices: Answer index: 1

Table 23: Question examples for each skill (part 3).

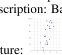
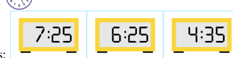
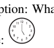
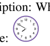
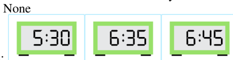
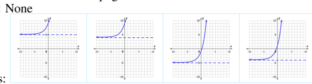
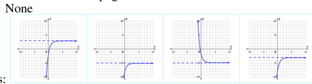
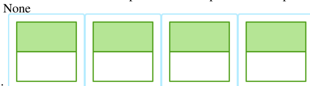
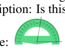
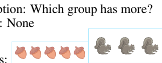
Subject: Math Skill: lines-line-segments-and-rays Description: What is this? Picture:  Choices: [line, line segment, ray,] Answer index: 1	Subject: Math Skill: make-predictions-with-scatter-plots Description: Based on the scatter plot below, which is a better prediction for x when y = 46? Picture:  Choices: [50, 98,] Answer index: 0
Subject: Math Skill: match-addition-sentences-and-models-sums-to-10 Description: Which shows 2+2=4? Picture: None Choices:  Answer index: 0	Subject: Math Skill: match-analog-and-digital-clocks Description: Look at the analog clock:Which digital clock shows the same time? Picture:  Choices:  Answer index: 0
Subject: Math Skill: match-analog-clocks-and-times Description: What time does the clock show? Picture:  Choices: [5:00, 4:30,] Answer index: 0	Subject: Math Skill: match-clocks-and-times Description: What time does the clock show? Picture:  Choices: [eight fifty, seven fifty, nine forty,] Answer index: 1
Subject: Math Skill: match-digital-clocks-and-times Description: Which clock shows six thirty-five? Picture: None Choices:  Answer index: 1	Subject: Math Skill: match-exponential-functions-and-graphs Description: formula_desc.png Picture: None Choices:  Answer index: 0
Subject: Math Skill: match-exponential-functions-and-graphs-ii Description: formula_desc.png Picture: None Choices:  Answer index: 2	Subject: Math Skill: match-fractions-to-models-halves-thirds-and-fourths Description: Look at the colored part of each shape. Which shape shows one-fourth? Picture: None Choices:  Answer index: 2
Subject: Math Skill: match-mixed-numbers-to-models Description: Which mixed number is shown? Picture:  Choices: [3 3/8, 4 2/8, 3 2/8, 3 5/8,] Answer index: 0	Subject: Math Skill: mean-find-the-missing-number Description: Susan has the following data:If the mean is 25, which number could r be? Picture:  Choices: [29, 38,] Answer index: 0
Subject: Math Skill: mean-median-mode-and-range-find-the-missing-number Description: Jayla has the following data:If the mean is 14, which number could s be? Picture:  Choices: [11, 3,] Answer index: 0	Subject: Math Skill: measure-angles-with-a-protractor Description: Is this angle acute, right, or obtuse? Picture:  Choices: [right, obtuse, acute,] Answer index: 2
Subject: Math Skill: median-find-the-missing-number Description: Danny has the following data:If the median is 97, which number could c be? Picture:  Choices: [98, 47,] Answer index: 0	Subject: Math Skill: model-and-solve-equations-using-algebra-tiles Description: Which equation does this set of algebra tiles represent? Picture:  Choices: [– 4x–1= – 9, – 8x–1= – 9, 8x–1= – 9, – x–1= – 10,] Answer index: 3
Subject: Math Skill: model-and-solve-linear-equations-using-algebra-tiles Description: Which equation does this set of algebra tiles represent? Picture:  Choices: [3x=27, 3x=24, 2x=26, 2x=24,] Answer index: 1	Subject: Math Skill: more Description: Which group has more? Picture: None Choices:  Answer index: 0

Table 24: Question examples for each skill (part 4).

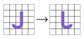
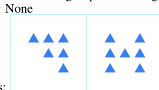
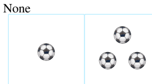
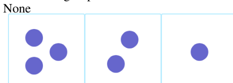
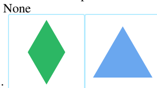
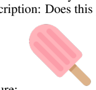
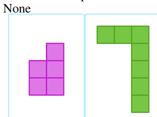
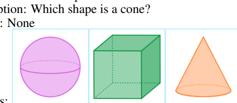
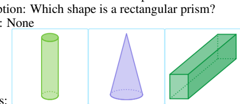
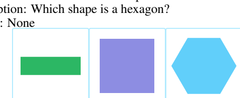
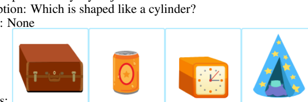
Subject: Math Skill: reflection-rotation-and-translation Description: How has this figure been transformed?It has been... Picture:  Choices: [translated, reflected, rotated,] Answer index: 1	Subject: Math Skill: regular-and-irregular-polygons Description: Is this shape a regular polygon? Picture:  Choices: [yes, no,] Answer index: 1
Subject: Math Skill: represent-numbers-up-to-10 Description: Which group has 6 triangles? Picture: None  Choices: Answer index: 0	Subject: Math Skill: represent-numbers-up-to-20 Description: Which picture shows 8 dots? Picture: None Choices:  Answer index: 0
Subject: Math Skill: represent-numbers-with-pictures-up-to-3 Description: Which shows 2? Picture: None  Choices: Answer index: 0	Subject: Math Skill: represent-numbers-with-pictures-up-to-5 Description: Which shows 1? Picture: None  Choices: Answer index: 0
Subject: Math Skill: represent-numbers-with-shapes-up-to-3 Description: Which group has 3 circles? Picture: None  Choices: Answer index: 0	Subject: Math Skill: represent-numbers-with-shapes-up-to-5 Description: Which group has 4 hexagons? Picture: None  Choices: Answer index: 0
Subject: Math Skill: rhombuses Description: Which shape is a rhombus? Picture: None  Choices: Answer index: 0	Subject: Math Skill: rotational-symmetry Description: Does this picture have rotational symmetry?  Picture: Choices: [no, yes,] Answer index: 0
Subject: Math Skill: rotational-symmetry-amount-of-rotation Description: This image has rotational symmetry. What is the smallest fraction of a full turn you need to rotate the image for it to look the same?  Picture: Choices: [1 2 of a full turn, 1 6 of a full turn, 1 4 of a full turn, 1 3 of a full turn,] Answer index: 0	Subject: Math Skill: scalene-isosceles-and-equilateral-triangles Description: Is this triangle scalene? Picture:  Choices: [yes, no,] Answer index: 1
Subject: Math Skill: select-figures-with-a-given-area Description: Which shape has an area of 7 square units? The shapes are made of unit squares. Picture: None  Choices: Answer index: 1	Subject: Math Skill: select-fractions-equivalent-to-whole-numbers-using-models Description: Count the equal parts. What fraction does this picture show? Picture:  Choices: [2/4, 4/8, 8/2, 2/8,] Answer index: 2
Subject: Math Skill: select-solid-shapes Description: Which shape is a cone? Picture: None  Choices: Answer index: 2	Subject: Math Skill: select-three-dimensional-shapes Description: Which shape is a rectangular prism? Picture: None  Choices: Answer index: 2
Subject: Math Skill: select-two-dimensional-shapes Description: Which shape is a hexagon? Picture: None  Choices: Answer index: 2	Subject: Math Skill: shapes-of-everyday-objects Description: Which is shaped like a cylinder? Picture: None  Choices: Answer index: 1

Table 25: Question examples for each skill (part 5).

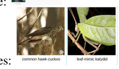
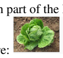
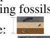
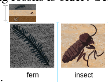
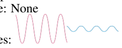
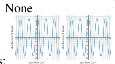
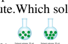
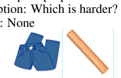
Subject: Science Skill: animal-adaptations-feet-and-limbs Description: Star-nosed moles are found in many parts of North America. They live in burrows. The moles eat earthworms and nuts, which they find in the soil. The feet of the star-nosed mole are adapted for digging.Which animal's feet are also adapted for digging? Picture:  Choices:  Answer index: 0	Subject: Science Skill: animal-adaptations-skins-and-body-coverings Description: Emerald tree boas live in the forests of South America. The tree boa is adapted to be camouflaged among green leaves.Which animal is also adapted to be camouflaged among green leaves? Picture:  Choices:  Answer index: 1
Subject: Science Skill: classify-elementary-substances-and-compounds-using-models Description: Complete the statement.Nitrogen is The model below represents a molecule of nitrogen. Nitrogen gas makes up nearly 80% of the air you breathe. Picture:  Choices: [an elementary substance, a compound,] Answer index: 0	Subject: Science Skill: classify-fruits-and-vegetables-as-plant-parts Description: People use lettuce plants for food. We usually eat the part of this plant that makes most of the food for the plant.Hint: A plant's leaves make food. A plant's seeds can grow into a new plant. Which part of the lettuce plant do we usually eat? Picture:  Choices: [the leaves, the seeds,] Answer index: 0
Subject: Science Skill: classify-matter-as-solid-liquid-or-gas Description: Is the water from a faucet a solid, a liquid, or a gas? Picture:  Choices: [a solid, a liquid, a gas,] Answer index: 1	Subject: Science Skill: classify-matter-as-solid-or-liquid Description: Is a coin a solid or a liquid? Picture:  Choices: [a liquid, a solid,] Answer index: 1
Subject: Science Skill: classify-rocks-and-minerals-by-color-and-shape Description: Select the black mineral. Picture: None Choices:  Answer index: 0	Subject: Science Skill: classify-rocks-and-minerals-by-color-shape-and-texture Description: Select the brown rock. Picture: None Choices:  Answer index: 1
Subject: Science Skill: classify-rocks-as-igneous-sedimentary-or-metamorphic Description: Diorite is a type of rock. When melted rock cools below the earth's surface, it can form diorite. Diorite is usually made of large mineral grains.What type of rock is diorite? Picture:  Choices: [sedimentary, igneous,] Answer index: 1	Subject: Science Skill: classify-symbiotic-relationships Description: Which type of relationship is formed when an Alcon blue caterpillar lives in a Myrmica ant nest?Read the passage. Then answer the question. Alcon blue butterflies spend the first part of their lives as caterpillars that live with Myrmica ants. When a caterpillar lives with the ants, it mimics, or pretends to be, an ant. The caterpillar can mimic the ants by copying their smell. The caterpillar can also make noises that make it sound like a queen ant. Queen ants receive more food and better protection than any other ants in the nest. So, when the caterpillar mimics an ant, the ants feed and protect the caterpillar instead of other ants in the nest. Picture:  Choices: [mutualistic, commensal, parasitic,] Answer index: 2
Subject: Science Skill: compare-ages-of-fossils-in-a-rock-sequence Description: This diagram shows fossils in an undisturbed sedimentary rock sequence.Which of the following fossils is older? Select the more likely answer. Picture:  Choices:  Answer index: 1	Subject: Science Skill: compare-amplitudes-and-wavelengths-of-waves Description: Select the wave with the greater amplitude. Picture: None Choices:  Answer index: 0
Subject: Science Skill: compare-amplitudes-wavelengths-and-frequencies-of-waves Description: Select the graph of the wave with the greater amplitude.The graphs below describe two waves. The waves are traveling at the same speed. Picture: None Choices:  Answer index: 1	Subject: Science Skill: compare-ancient-and-modern-organisms-use-observations-to-support-a-hypothesis Description: Which statement supports the following hypothesis?The American lobster and Homarus hakelensis have similar adaptations to survive underwater. The American lobster and Homarus hakelensis have similar adaptations to survive underwater. Picture:  Choices: [Homarus hakelensis used its claws to find food underwater, The American lobster uses its claws to find food underwater, The American lobster uses its claws to find food underwater,] Answer index: 2
Subject: Science Skill: compare-concentrations-of-solutions Description: The diagram below is a model of two solutions. Each green ball represents one particle of solute.Which solution has a higher concentration of green particles? Picture:  Choices: [Solution B, Solution A, neither; their concentrations are the same,] Answer index: 0	Subject: Science Skill: compare-magnitudes-of-magnetic-forces Description: Think about the magnetic force between the magnets in each pair. Which of the following statements is true?The images below show two pairs of magnets. The magnets in different pairs do not affect each other. All the magnets shown are made of the same material, but some of them are different shapes. Picture:  Choices: [The magnitude of the magnetic force is smaller in Pair 2., The magnitude of the magnetic force is the same in both pairs., The magnitude of the magnetic force is smaller in Pair 1.,] Answer index: 1
Subject: Science Skill: compare-properties-of-materials Description: Which is harder? Picture: None Choices:  Answer index: 1	Subject: Science Skill: compare-properties-of-objects Description: Which property do these four objects have in common?Select the best answer. Picture:  Choices: [sticky, sour, soft,] Answer index: 2

Table 26: Question examples for each skill (part 6).

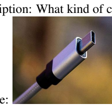
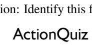
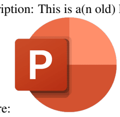
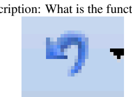
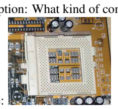
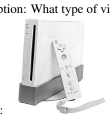
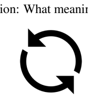
Subject: Science Skill: use-data-to-describe-world-climates Description: Which statement best describes the climate of Santa Fe?Hint: Summers in the Northern Hemisphere occur in June, July, and August. Winters in the Northern Hemisphere occur in December, January, and February. Santa Fe, New Mexico, is a city in the United States. It has a semiarid climate.  Picture: Choices: [Winters have much lower temperatures than summers., Winters have less precipitation than summers.,] Answer index: 0	Subject: Science Skill: use-evidence-to-classify-animals Description: Placental mammals are a group of animals with similar traits. The following traits can be used to identify placental mammals:They give birth to live offspring. They have fur or hair. Observe the animals and read the descriptions. Select the one animal that has all of the placental mammal traits listed above. Sea otters have very thick fur. Their fur helps keep them warm in cold water. Female sea otters give birth to live offspring in the water. Red salamanders do not have lungs! They can breathe through their moist, smooth skin. Adult red salamanders live near rivers or ponds. They lay eggs with no shells under rocks or logs. The baby red salamanders live underwater. Picture: None Choices:  Answer index: 0
Subject: Science Skill: use-evidence-to-classify-mammals-birds-fish-reptiles-and-amphibians Description: Fish are a group of animals with similar traits. The following traits can be used to identify fish:They have fins, not limbs. They make eggs with no shells. Observe the animals and read the descriptions. Select the one animal that has all of the fish traits listed above. Thresher sharks hatch from eggs with no shells. They have a long tail and fins. They can use their tail to hit and stun their prey. Thresher sharks live in salt water. Greater flameback woodpeckers have feathers and two wings. They use their strong beaks to make holes in trees. The woodpeckers use these holes as nests for their eggs, which have white shells. Picture: None Choices:  Answer index: 0	Subject: Science Skill: use-punnett-squares-to-calculate-probabilities-of-offspring-types Description: In a group of dachshund dogs, some individuals have rough fur and others have soft fur. In this group, the gene for the fur texture trait has two alleles. The allele for rough fur (F) is dominant over the allele for soft fur (f).This Punnett square shows a cross between two dachshund dogs. What is the probability that a dachshund dog produced by this cross will be homozygous dominant for the fur texture gene? Picture:  Choices: [3/4, 0/4, 2/4, 1/4, 4/4,] Answer index: 2
Subject: Science Skill: use-punnett-squares-to-calculate-ratios-of-offspring-types Description: In a group of Syrian hamsters, some individuals have short fur and others have long fur. In this group, the gene for the fur length trait has two alleles. The allele for short fur (F) is dominant over the allele for long fur (f).This Punnett square shows a cross between two Syrian hamsters. What is the expected ratio of offspring with long fur to offspring with short fur? Choose the most likely ratio. Picture:  Choices: [3:1, 1:3, 0:4, 2:2, 4:0,] Answer index: 2	Subject: Science Skill: use-scientific-names-to-classify-organisms Description: This organism is a mantled howler. Its scientific name is Alouatta palliata.Select the organism in the same species as the mantled howler. Picture:   Choices: Answer index: 1
Subject: Science Skill: weather-and-climate-around-the-world Description: Does this passage describe the weather or the climate?Hint: Weather is what the atmosphere is like at a certain place and time. Climate is the pattern of weather in a certain place. A cloud forest is a mountain ecosystem that is home to a wide variety of species. The skies were mostly clear last week over this cloud forest, which is in Ecuador.  Picture: Choices: [weather, climate,] Answer index: 0	Subject: Technology Skill: cables Description: What kind of computer related plug or port do you see here?  Picture: Choices: [USB type-A port, HDMI plug, VGA port, USB type-C plug,] Answer index: 3
Subject: Technology Skill: font Description: Identify this font type  Picture: Choices: [Times Ancient Roman, Matisse ITC, Human521 BT, Bookman Old Style,] Answer index: 2	Subject: Technology Skill: icons Description: This is a(n old) logo of which famous app or program?  Picture: Choices: [Acrobat Reader, Google Pay, Microsoft Office PowerPoint, GoFundMe,] Answer index: 2
Subject: Technology Skill: logo Description: This is (part of) a (former) logo of which computer related brand?  Picture: Choices: [Imation, Cisco, Nintendo, Verbatim,] Answer index: 3	Subject: Technology Skill: others Description: What is the function of this key?  Picture: Choices: [Copy, Undo, Delete, Paste,] Answer index: 1
Subject: Technology Skill: parts Description: What kind of computer component do you see here?  Picture: Choices: [Power Supply Unit, Computer Fan, CPU Socket, Molex Connector,] Answer index: 2	Subject: Technology Skill: peripherals Description: What kind of computer peripheral do you see here?  Picture: Choices: [Floppy Disk, DVD Spindle, Tablet, Bluetooth Headset,] Answer index: 3
Subject: Technology Skill: photo Description: What type of video game console do you see here?  Picture: Choices: [Nintendo Wii, Microsoft Xbox One, Microsoft Xbox, Mattel Intellivision,] Answer index: 0	Subject: Technology Skill: web Description: What meaning or function is usually associated with this web interface symbol?  Picture: Choices: [Storage for deleted files, Computer games, Reload/Refresh, Send e-mail,] Answer index: 2

Table 27: Question examples for each skill (part 7).