Kentucky Summative Assessments

Grade 11 Science
Released Items
2023

SCHS1617_00

Jesse and his dad were stopped in traffic because a work crew was painting a metal bridge. Jesse asked his dad, "Why do they need to paint the bridge?" His dad explained that the paint was needed to prevent the chemical reaction of rusting.

Iron + Oxygen → Iron (III) Oxide

Jesse says, "Rusting is a chemical reaction? I thought rust was just something that happened."

1

SCHS1617_11_2

Which of these statements will help Jesse understand rust is actually a chemical reaction?

A Rust is not on the periodic table, so it is not a chemical.

B Color change is a common indicator of chemical reactions.

C Rusting is a rapid process that can be observed while it is happening.

D The reactants both must be in the same phase for a chemical reaction to occur.

Released Item Performance

Kentucky Summative Assessments

Spring 2023
Grade 11
Science

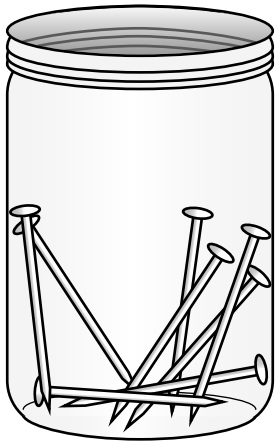
Item: SCHS1617_11
Book Question Number: 1

Standard: HS-PS1-2

Item Type: MC
Key: B

Student Group	Number of Students	Percent Correct	Average Item Score	Item Breakout Statistics - Answer Choice Options			
				A (%)	B (%)	C (%)	D (%)
All Students	**31,424**	66%	0.66	4%	66%	13%	17%
Gender							
Female	**15,606**	69%	0.69	3%	69%	12%	16%
Male	**15,816**	63%	0.63	5%	63%	15%	18%
Ethnicity							
African American	**2,997**	56%	0.56	6%	56%	20%	18%
American Indian or Alaska Native	**40**	65%	0.65	5%	65%	10%	20%
Asian	**701**	74%	0.74	3%	74%	9%	14%
Hispanic or Latino	**2,476**	62%	0.62	5%	62%	13%	20%
Native Hawaiian or Pacific Islander	**38**	68%	0.68	3%	68%	11%	18%
White (non-Hispanic)	**23,911**	67%	0.67	4%	67%	13%	16%
Two or more races	**1,256**	67%	0.67	4%	67%	14%	15%
Migrant	**97**	58%	0.58	8%	58%	11%	23%
English Learner	**884**	42%	0.42	9%	42%	21%	28%
Economically Disadvantaged	**16,108**	61%	0.61	5%	61%	16%	18%
Students with Disabilities	**1,644**	47%	0.47	7%	47%	20%	26%

SCHS1617_00a



Jesse's family decides to conduct an experiment about rust to help Jesse understand. They predict what will happen when rusting nails are placed into a glass jar.

- Jake says, "When the nails rust, the jar will get heavier."
- Paula says, "When the nails rust, the jar will stay the same weight."
- Dad says, "It depends."
- Jesse says, "When the nails rust, the jar will get lighter."

Jesse's family members immediately tell Jesse that his prediction can't be right.

2

SCHS1617_02_3

Which one of these statements **best** explains why the rest of Jesse's family told Jesse his prediction can't be right?

A When things rust, they fall apart.

B Chemical reactions always make things heavier.

C The rusting reaction doesn't remove a substance.

D Rusting gives off a gas that makes the rust heavier.

Released Item Performance

Kentucky Summative Assessments

Spring 2023
Grade 11
Science

Item: SCHS1617_02
Book Question Number: 2

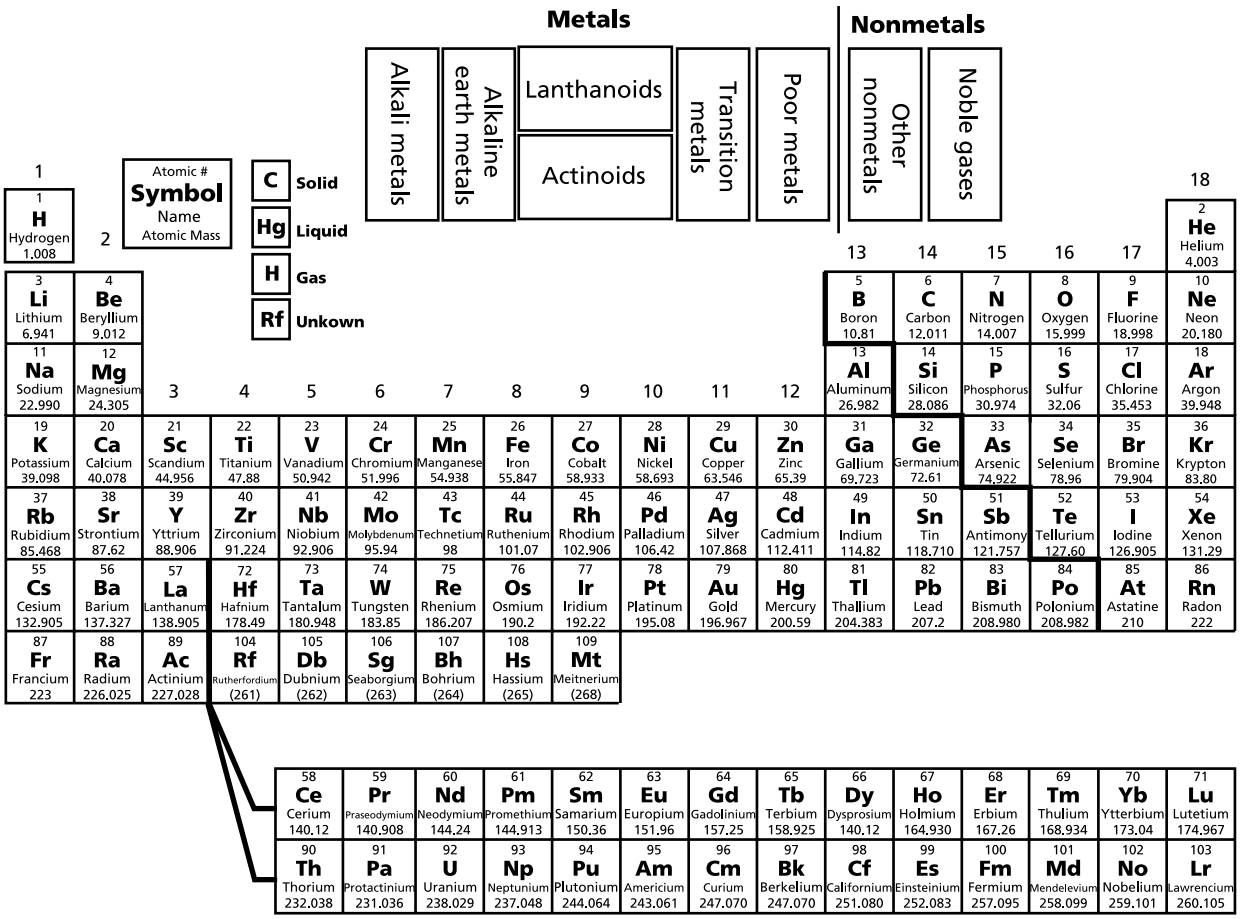
Standard: HS-PS1-7

Item Type: MC
Key: C

Student Group	Number of Students	Percent Correct	Average Item Score	Item Breakout Statistics - Answer Choice Options			
				A (%)	B (%)	C (%)	D (%)
All Students	**31,429**	65%	0.65	13%	8%	65%	14%
Gender							
Female	**15,605**	66%	0.66	11%	8%	66%	15%
Male	**15,822**	64%	0.64	15%	9%	64%	13%
Ethnicity							
African American	**2,997**	51%	0.51	17%	14%	51%	18%
American Indian or Alaska Native	**40**	63%	0.63	18%	5%	63%	15%
Asian	**701**	74%	0.74	7%	7%	74%	13%
Hispanic or Latino	**2,479**	57%	0.57	16%	12%	57%	15%
Native Hawaiian or Pacific Islander	**38**	45%	0.45	21%	18%	45%	16%
White (non-Hispanic)	**23,912**	67%	0.67	12%	7%	67%	13%
Two or more races	**1,257**	61%	0.61	14%	10%	61%	15%
Migrant	**97**	48%	0.48	20%	11%	48%	21%
English Learner	**886**	36%	0.36	20%	25%	36%	19%
Economically Disadvantaged	**16,109**	59%	0.59	15%	10%	59%	16%
Students with Disabilities	**1,645**	45%	0.45	23%	14%	45%	18%

The family debated why they believed their predictions were correct. The conversation soon turned to Dad's comment, "It depends." Dad explained his answer by saying, "It really depends on whether we put the lid on the jar. Either Jake or Paula could be right."

Periodic Table of the Elements



3

SCHS1617_10_5,1

Which statements describe why either Jake's or Paula's prediction could be correct, depending on whether the jar remains closed or open?

Select the TWO **best** answers.

A The mass of the jar will increase when the jar is open.

B The mass of the jar will decrease when the jar is open.

C The mass of the jar will increase when the jar is closed.

D The mass of the jar will not change when the jar is open.

E The mass of the jar will not change when the jar is closed.

Released Item Performance

Kentucky Summative Assessments

Spring 2023
Grade 11
Science

Item: SCHS1617_10
Book Question Number: 3

Standard: HS-PS1-7

Item Type: MS
Key: A,E

Student Group	Number of Students	Percent Correct	Average Item Score	Item Breakout Statistics - Score Percentages		
				Score 0 (%)	Score 1 (%)	Score 2 (%)
All Students	**31,422**	31.3%	0.63	50%	38%	12%
Gender						
Female	**15,602**	28.6%	0.57	53%	36%	10%
Male	**15,818**	33.9%	0.68	46%	40%	14%
Ethnicity						
African American	**2,996**	29.7%	0.59	49%	43%	8%
American Indian or Alaska Native	**40**	37.5%	0.75	43%	40%	18%
Asian	**701**	36.2%	0.72	47%	34%	19%
Hispanic or Latino	**2,477**	29.8%	0.60	51%	39%	10%
Native Hawaiian or Pacific Islander	**38**	21.1%	0.42	66%	26%	8%
White (non-Hispanic)	**23,908**	31.5%	0.63	50%	38%	13%
Two or more races	**1,257**	30.3%	0.61	49%	41%	10%
Migrant	**97**	33.5%	0.67	41%	51%	8%
English Learner	**884**	28.8%	0.58	50%	43%	7%
Economically Disadvantaged	**16,106**	30.0%	0.60	50%	40%	10%
Students with Disabilities	**1,645**	31.4%	0.63	45%	47%	8%

SCHS1617_00c

Jesse thinks about some things around his home that have rust on them, such as his old bike, the metal grille on the family's car, and some tools. He asked his teacher, "Can we predict how things might rust?" His teacher replied, "Rusting is a type of reaction called oxidation. You need to know the outer shell electron configuration to predict how a substance will oxidize."

4

SCHS1617_04_4

What one periodic pattern would **most likely** help Jesse predict the correct chemical formula for lithium + oxygen → lithium oxide?

A The atomic masses of these elements.

B The number of neutrons these elements contain.

C The location of the elements within their rows (period).

D The location of the elements within their columns (group).

Released Item Performance

Kentucky Summative Assessments

Spring 2023
Grade 11
Science

Item: SCHS1617_04
Book Question Number: 4

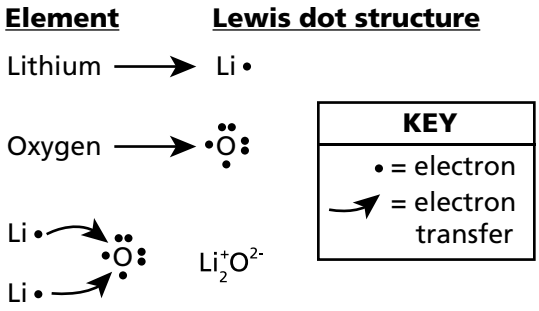
Standard: HS-PS1-2

Item Type: MC
Key: D

Student Group	Number of Students	Percent Correct	Average Item Score	Item Breakout Statistics - Answer Choice Options			
				A (%)	B (%)	C (%)	D (%)
All Students	**31,419**	23%	0.23	24%	31%	22%	23%
Gender							
Female	**15,601**	23%	0.23	25%	31%	20%	23%
Male	**15,816**	23%	0.23	22%	31%	24%	23%
Ethnicity							
African American	**2,997**	18%	0.18	26%	33%	24%	18%
American Indian or Alaska Native	**40**	18%	0.18	30%	35%	18%	18%
Asian	**701**	30%	0.30	22%	24%	24%	30%
Hispanic or Latino	**2,475**	22%	0.22	23%	33%	21%	22%
Native Hawaiian or Pacific Islander	**38**	18%	0.18	24%	34%	24%	18%
White (non-Hispanic)	**23,908**	24%	0.24	24%	31%	22%	24%
Two or more races	**1,255**	23%	0.23	25%	30%	23%	23%
Migrant	**97**	26%	0.26	18%	34%	23%	26%
English Learner	**883**	18%	0.18	24%	35%	24%	18%
Economically Disadvantaged	**16,104**	21%	0.21	23%	33%	22%	21%
Students with Disabilities	**1,643**	19%	0.19	22%	33%	26%	19%

SCHS1617_00d

Jesse's teacher shows him a model that illustrates the electron configuration of lithium (Li) reacting with oxygen (O) to form lithium oxide. This type of model is commonly used to illustrate how periodic patterns help make predictions about how elements will bond to form compounds. Based on this model, Li and O are likely to combine to form lithium oxide.



Jesse wonders if he can use this type of model to illustrate how the rusting of iron occurs.

GO ON▶

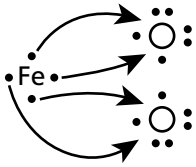
5

SCHS1617_05_3

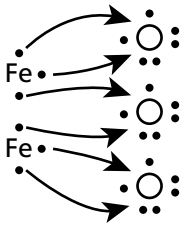
Which one of these models **best** demonstrates the correct atomic configuration and electron transfer that occurs in the formation of iron (III) oxide?

A

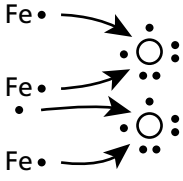
B



C



D



Released Item Performance

Kentucky Summative Assessments

Spring 2023
Grade 11
Science

Item: SCHS1617_05
Book Question Number: 5

Standard: HS-PS1-2, HS-PS1-7

Item Type: MC
Key: C

Student Group	Number of Students	Percent Correct	Average Item Score	Item Breakout Statistics - Answer Choice Options			
				A (%)	B (%)	C (%)	D (%)
All Students	**31,412**	41%	0.41	15%	27%	41%	18%
Gender							
Female	**15,599**	39%	0.39	14%	28%	39%	19%
Male	**15,811**	42%	0.42	16%	26%	42%	17%
Ethnicity							
African American	**2,995**	39%	0.39	14%	30%	39%	18%
American Indian or Alaska Native	**40**	40%	0.40	10%	33%	40%	18%
Asian	**701**	46%	0.46	18%	17%	46%	19%
Hispanic or Latino	**2,475**	39%	0.39	14%	30%	39%	17%
Native Hawaiian or Pacific Islander	**38**	45%	0.45	11%	29%	45%	16%
White (non-Hispanic)	**23,902**	41%	0.41	15%	26%	41%	18%
Two or more races	**1,256**	41%	0.41	14%	27%	41%	18%
Migrant	**97**	35%	0.35	13%	34%	35%	18%
English Learner	**880**	38%	0.38	15%	31%	38%	15%
Economically Disadvantaged	**16,103**	40%	0.40	14%	29%	40%	17%
Students with Disabilities	**1,643**	38%	0.38	15%	30%	38%	17%

SCHS1617_00e

Jesse says, "I can use patterns on the periodic table to predict all kinds of things. I predict that iron will bond with sulfur to form a molecule similar to the way a molecule forms when rusting occurs."

6

SCHS1617_06_3

Which one of these patterns of the periodic table **best** allows Jesse to make this prediction?

A Sulfur and oxygen are usually gases.

B Sulfur and oxygen are in different rows.

C Sulfur and oxygen are in the same family.

D Sulfur and oxygen have similar electronegativity.

Released Item Performance

Kentucky Summative Assessments

Spring 2023
Grade 11
Science

Item: SCHS1617_06
Book Question Number: 6

Standard: HS-PS1-2

Item Type: MC
Key: C

Student Group	Number of Students	Percent Correct	Average Item Score	Item Breakout Statistics - Answer Choice Options			
				A (%)	B (%)	C (%)	D (%)
All Students	**31,419**	38%	0.38	19%	16%	38%	27%
Gender							
Female	**15,600**	39%	0.39	19%	15%	39%	27%
Male	**15,817**	37%	0.37	19%	16%	37%	27%
Ethnicity							
African American	**2,998**	33%	0.33	23%	19%	33%	24%
American Indian or Alaska Native	**40**	38%	0.38	23%	23%	38%	18%
Asian	**700**	42%	0.42	14%	14%	42%	31%
Hispanic or Latino	**2,473**	36%	0.36	22%	17%	36%	25%
Native Hawaiian or Pacific Islander	**38**	45%	0.45	24%	13%	45%	18%
White (non-Hispanic)	**23,908**	39%	0.39	19%	15%	39%	27%
Two or more races	**1,257**	39%	0.39	21%	16%	39%	25%
Migrant	**97**	36%	0.36	26%	11%	36%	27%
English Learner	**879**	28%	0.28	23%	23%	28%	26%
Economically Disadvantaged	**16,106**	36%	0.36	21%	17%	36%	27%
Students with Disabilities	**1,644**	30%	0.30	21%	24%	30%	25%

SCHS1617_00f

Now that Jesse understands the importance of oxygen in causing iron to rust, he realizes that the purpose for painting the bridge is to keep the two reactants separated. If the paint peels, the iron will begin to rust. He remembers that his dad said meats, apples, avocados, and other foods undergo this process.

7

SCHS1617_07_2

Which one choice **best** demonstrates a way to prevent the process of oxidation that is similar to the way the painting of bridges prevents the process of oxidation?

A Meat is kept in the freezer until it is cooked.

B Apples aren't peeled until just before they are eaten.

C Bacon is soaked in a salt solution before it is packaged.

D Avocados are mashed before serving to increase their surface area.

Released Item Performance

Kentucky Summative Assessments

Spring 2023
Grade 11
Science

Item: SCHS1617_07
Book Question Number: 7

Standard: HS-PS1-5

Item Type: MC
Key: B

Student Group	Number of Students	Percent Correct	Average Item Score	Item Breakout Statistics - Answer Choice Options			
				A (%)	B (%)	C (%)	D (%)
All Students	**31,411**	39%	0.39	29%	39%	26%	6%
Gender							
Female	**15,598**	42%	0.42	29%	42%	24%	5%
Male	**15,811**	35%	0.35	30%	35%	29%	6%
Ethnicity							
African American	**2,998**	27%	0.27	40%	27%	23%	10%
American Indian or Alaska Native	**40**	43%	0.43	30%	43%	20%	8%
Asian	**700**	45%	0.45	26%	45%	24%	4%
Hispanic or Latino	**2,472**	31%	0.31	34%	31%	26%	8%
Native Hawaiian or Pacific Islander	**38**	29%	0.29	32%	29%	32%	8%
White (non-Hispanic)	**23,901**	41%	0.41	27%	41%	27%	5%
Two or more races	**1,257**	37%	0.37	33%	37%	25%	5%
Migrant	**96**	19%	0.19	39%	19%	30%	13%
English Learner	**878**	25%	0.25	33%	25%	22%	19%
Economically Disadvantaged	**16,101**	34%	0.34	32%	34%	26%	7%
Students with Disabilities	**1,644**	27%	0.27	33%	27%	28%	12%

SCHS1617_00g

The oxidization of iron causes the bonding characteristics of the new substance to be different. Once iron has oxidized, it tends to flake off easily from the original structure, exposing new iron to be oxidized.

Jesse reads about how bridges sometimes collapse because uncontrolled rusting weakens their parts.

8

SCHS1617_08

Which one of the following bridges would probably be weakened **most** rapidly by oxidation? Explain why you chose this bridge based on the factors influencing reaction rates.

- Unpainted iron bridge in Alaska
- Painted iron bridge in Alaska
- Unpainted iron bridge in Florida
- Painted iron bridge in Florida

Released Item Performance

Kentucky Summative Assessments

Spring 2023
Grade 11
Science

Item: SCHS1617_08
Book Question Number: 8

Standard: HS-PS1-5

Item Type: ER
Key: Rubric

Student Group	Number of Students	Percent Correct	Average Item Score	Item Breakout Statistics - Score Percentages				
				Score 0 (%)	Score 1(%)	Score 2 (%)	Score 3 (%)	Score 4 (%)
All Students	**29,011**	27.7%	1.11	25%	45%	25%	5%	1%
Gender								
Female	**14,789**	29.0%	1.16	24%	43%	27%	5%	1%
Male	**14,221**	26.4%	1.06	26%	47%	22%	4%	1%
Ethnicity								
African American	**2,533**	19.2%	0.77	41%	42%	14%	2%	0%
American Indian or Alaska Native	**35**	27.1%	1.09	20%	54%	23%	3%	0%
Asian	**682**	35.8%	1.43	18%	36%	34%	10%	2%
Hispanic or Latino	**2,239**	24.7%	0.99	30%	46%	21%	3%	0%
Native Hawaiian or Pacific Islander	**34**	17.6%	0.71	38%	53%	9%	0%	0%
White (non-Hispanic)	**22,369**	28.8%	1.15	23%	45%	26%	5%	1%
Two or more races	**1,115**	26.3%	1.05	27%	46%	23%	4%	1%
Migrant	**84**	19.6%	0.79	36%	50%	14%	0%	0%
English Learner	**717**	13.5%	0.54	55%	37%	7%	1%	0%
Economically Disadvantaged	**14,557**	24.2%	0.97	31%	46%	20%	3%	0%
Students with Disabilities	**1,434**	17.5%	0.70	43%	45%	11%	1%	0%

	Kentucky Academic Standards Science Rubric
Score Point	**Description**
4	There is evidence in this response that the student has a complete and thorough understanding of the multi-dimensional question as evidenced by their explanation of the phenomenon and/or solution to the problem. The response is complete, thorough and correct and based on appropriate knowledge and skills The response does not contain errors or flaws in logical thinking or those flaws are irrelevant to the accuracy of the answer The response reflects complete synthesis and understanding of complex ideas The response is completely coherent and based on effective application of relevant dimensions (SEP and/or DCI and/or CC) The response integrates a solution that is completely correct and based on the principles of engineering design (if applicable)
3	There is evidence in this response that the student has a general understanding of the multi-dimensional question as evidenced by their explanation of the phenomenon and/or solution to the problem. The response is generally complete and the question is answered using appropriate knowledge and skills The response may contain minor errors or flaws in logical thinking and those flaws may or may not be irrelevant to the accuracy of the answer The response reflects a general synthesis and understanding of complex ideas The response is generally coherent and based on application of relevant dimensions (SEP and/or DCI and/or CC) The response integrates a solution that is generally correct and mostly based on the principles of engineering design (if applicable).
2	There is evidence in this response that the student has a limited understanding of the multi-dimensional question as evidenced by their explanation of the phenomenon and/or solution to the problem. The response is partially complete and/or the question is answered using limited understanding of knowledge and skills The response may contain significant errors or flaws in logical thinking The response reflects a limited synthesis and understanding of complex ideas The response may or may not be coherent and based on some application of relevant dimensions (SEP and/or DCI and/or CC) The response integrates a solution that is partly correct and may or may not be based on the principles of engineering design (if applicable).
1	There is evidence in this response that the student has a minimal understanding of the multi-dimensional question as evidenced by their explanation of the phenomenon and/or solution to the problem. The response is minimal and/or the question is answered using minimal understanding of knowledge and skills The response may contain major significant errors or flaws in logical thinking The response reflects a minimal synthesis and understanding of complex ideas The response is not coherent or is not based on application of relevant dimensions (SEP and/or DCI and/or CC) The response integrates a solution that is minimally correct and may or may not be based on the principles of engineering design (if applicable).
0	There is no evidence that the student has an understanding of the material related to the question being asked in terms of science content and logical thinking skills. The response is blank, entirely incorrect and/or irrelevant.

Anchor Set

A1

16. I think the painted iron bridge in Alaska because Alaska is a cold, wet place with lots of snow. the water that remains on the bridge will eventually cause it to rust under the paint. the paint will then spread the rust faster underneath causing it to deteanate.

Anchor Annotation, Paper 1
Score Point 0

There is no evidence that the student has an understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The incorrect selection of a painted iron bridge in Alaska along with an explanation that is irrelevant indicates a lack of understanding of the material related to the question.

A2

An unpainted bridge in Alaska would most likely oxidize the fastest. The unpainted bridge has no layer between the bridge and cold wether from Alaska: that has high oxygen levels. The level of oxygen from the cold air is more than in warmer air, The colder oxygen is more dense, and the more density makes the oxygen stronger against the unpainted bridge, which metal is exposed.

Anchor Annotation, Paper 2
Score Point 0

There is no evidence that the student has an understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The selection of an unpainted bridge in Alaska is incorrect. Although an attempt is made to explain oxygen's effect on the bridge (The level of oxygen from the cold air is more than in warmer air), the explanation is incorrect, indicating a lack of understanding of the question.

A3

A painted iron bridge in Flordia would be weakened most rapidly because it has been painted before. “Once iron has been oxidized, it tends to flake off easily from the original structure, exposing new iron to be oxidized.” The heat would have a factor on the rapid weakness on the bridge also.

Anchor Annotation, Paper 3
Score Point 0

There is no evidence that the student has an understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The response contains a vague statement regarding heat and rapid weakening on the bridge as well as a quote from the stem material describing oxidization and flake-off that exposes new iron to additional oxidization. This information on its own is not relevant. As such, this explanation, along with the selection of an incorrect bridge, indicates a lack of understanding of the material related to the question.

A4

I believe an unpainted bridge in florida would be weakend the most by oxidation because there would be nothing protecting the bare iron. Therefore, it would oxidize faster.

Anchor Annotation, Paper 4
Score Point 1

There is evidence in this response that the student has minimal understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The selection of an unpainted bridge in Florida is correct. The explanation (there would be nothing protecting the bare iron. Therefore, it would oxidize faster) lacks elaboration and specifics, but does minimally support the choice of this bridge.

A5

unpainted bridge in florida due to the heat and humidity of the states location

Anchor Annotation, Paper 5
Score Point 1

There is evidence in this response that the student has minimal understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The correct bridge is indicated along with factors in Florida (heat and humidity) to support the selection of an unpainted bridge in that state. This explanation lacks supporting evidence but is correct, indicating a minimal understanding of the question being asked.

A6

An unpainted bridge in florida would be weatered most rapidly by oxidation. Since there is a lot of rain and salt in the area it only speeds up the process

Anchor Annotation, Paper 6
Score Point 1

There is evidence in this response that the student has minimal understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The correct bridge is indicated along with an attempt to provide factors and results of these factors that would affect the bridge (rain and salt in the area . . . it only speeds up the process) as support for the selection of an unpainted bridge in Florida. This level of support indicates a minimal comprehension of the multi-dimensional question being asked.

A7

Unpainted iron bridge in Florida will rust more rapidly. It is always warm in Florida so thats why it would rust faster than it would in Alaska. Since it is unpainted their is nothing to keep oxygen from getting to it so it's gonna rust quick.

Anchor Annotation, Paper 7
Score Point 2

There is evidence in this response that the student has limited understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The bridge selection is correct, and the explanation reflects limited synthesis. The explanation correctly indicates climate will be a determining factor (It is always warm in Florida so thats why it would rust faster than it would in Alaska), which supports the selection of a bridge in Florida. Support for the selection of an unpainted bridge is also accurate (Since it is unpainted their is nothing to keep oxygen from getting to it so it's gonna rust quick). Note that, as compared to the previous response, there is additional information here that is relevant and correct, adding more support that indicates a holistic level of understanding that is more limited than minimal.

A8

I believe the unpainted bridge in Florida will most rapidly oxidize quicker because if its unpainted then the iron will oxidize quicker and where it is in the heat most of the time, the iron will rust faster. Unlike the others that are either painted or in the cold which would make the bridge oxidize slower. That is why, the bridge that is unpainted in Florida will be the most weak and most rapidly oxidized/Rust quickest bridge.

Anchor Annotation, Paper 8
Score Point 2

There is evidence in this response that the student has limited understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The unpainted bridge in Florida is indicated and the explanation supports this selection (if its unpainted then the iron will oxidize quicker and where it is in the heat most of the time, the iron will rust faster). Some additional development is provided to support the reasoning behind not selecting the other bridges (Unlike the others that are either painted or in the cold which would make the bridge oxidize slower), reflecting limited synthesis and understanding. The lack of elaboration to explain why oxidation and rust are more likely to occur on unpainted iron where it is warm prevents the response from being considered more than limited.

A9

I believe a unpainted Iron bridge in Florida would be the weakest. Due to Heat within Florida, the oxygen atoms move more Rapidly, causing the iron bridge to rust faster. Also, due to Acid Rain & large amounts of presipation would cause oxidation to occur over a shorter amount of time. Also, due to main kind adding weight onto the bridge, oxidation would & will make the bridge weaker.

Anchor Annotation, Paper 9
Score Point 2

There is evidence in this response that the student has limited understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The most salient support for the correct selection of the unpainted iron bridge in Florida (Due to Heat within Florida, the oxygen atoms move more Rapidly, causing the iron bridge to rust faster) is correct and indicates some limited understanding, although it lacks additional elaboration to clarify why this molecular movement will increase the rate at which the bridge rusts. The information regarding acid rain and large amounts of precipitation adds some limited support but also lacks additional elaboration (due to Acid Rain & large amounts of presipation would cause oxidation to occur over a shorter amount of time). The reasoning behind choosing an unpainted bridge is not addressed, and the information regarding people adding weight to the bridge is not relevant but does not detract.

A10

The unpainted bridge in Florida would rust the fastest because of the heated climate. Particles move faster and cause a faster reaction to an iron bridge with no paint. Oxidation would be constantly occuring in a heated climate rather than a moderate and cool climate like Alaska.

Anchor Annotation, Paper 10
Score Point 3

There is evidence in this response that the student has a general understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The explanation supporting the selection of an unpainted bridge in Florida is correct and indicates general understanding of why the bridge was chosen (because of the heated climate. Particles move faster and cause a faster reaction to an iron bridge with no paint). The idea of why a bridge with no paint is selected is not clearly developed, although the final sentence (Oxidation would be constantly occuring in a heated climate rather than a moderate and cool climate like Alaska) does make mention of constant oxidation, which would be an accurate result for an unpainted bridge, but this connection is not clearly integrated into the response. As such, the response reflects a general synthesis and understanding of the complex ideas associated with the question. Note that, in comparison to Anchor paper 9, in this response the inclusion of the idea of increased reaction time due to heat and increased particle movement helps to clarify why this increased movement is significant.

A11

I would say the unpainted iron bridge in Florida because the salty rain fall and higher tempratures would cause the bridge to rust faster. The upainted bridge would rust much faster than the painted one because it doesnt have that extra layer of protection to protect it from erroding And I believe the bridge in Florida would rust faster because of the salt water and warm tempratures, while in alaska it is always cold and might slow down the rusting proccess.

Anchor Annotation, Paper 11
Score Point 3

There is evidence in this response that the student has a general understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The response is generally correct with an accurate assertion that the unpainted bridge in Florida would weaken most rapidly. The explanation for why an unpainted bridge would weaken most rapidly is generally correct (it doesnt have that extra layer of protection to protect it from erroding). The explanation for why a bridge in Florida would be more susceptible to oxidation than one in Alaska synthesizes the climate of Florida (the salty rain fall and higher tempratures) and explains a lower rate of oxidation in Alaska (it is always cold and might slow down the rusting proccess). Holistically, the response is generally complete and reflects a general synthesis and understanding of complex ideas.

A12

The bridge that will weaken most rapidly is the unpainted bridge in Florida. My reason for this is not only is it exposed to oxygen for not being painted, but also the bridge is open for more elements to affect it. Florida is known for its sunny beaches which has salt and high humidity. These elements could help the process of chemically reacting with the oxygen to speed up the oxidation process. Unlike Florida, Alaska is known to be cold and have snow. Since cold temperatures have matter contract as well as have the bridges being covered in frost from the weather, it’s more unlikely for the unpainted bridge to rust than the unpainted brdge in Florida.

Anchor Annotation, Paper 12
Score Point 3

There is evidence in this response that the student has a general understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The unpainted bridge in Florida is correct and the explanation that supports the selection of an unpainted bridge is generally complete (not only is it exposed to oxygen for not being painted, but also the bridge is open for more elements to affect it). The explanation that supports Florida is generally correct (Florida is known for its sunny beaches which has salt and high humidity. These elements could help the process of chemically reacting with the oxygen to speed up the oxidation process). Note that this portion of the explanation would be strengthened with clarification that the reaction is with iron. Some supporting evidence is included to explain why a bridge in Alaska is excluded (Since cold temperatures have matter contract as well as have the bridges being covered in frost). Holistically, the response demonstrates a general understanding.

A13

The unpainted iron bridge in Florida would probably be weakened most rapidly by oxidation. An unpainted bridge would be weakened most rapdily because nothing is keeping the iron and oxygen separated, resulting in nothing hindering the reaction. A bridge would be weakened faster in Florida than in Alaska because of the warmer weather. Warmer weather allows the reaction to take place faster because the molecules will be moving quicker. In Alaska, where it's cold, the molecules would move slower. Therefore, an unpainted bridge in Florida would be weakened most rapidly by oxidation.

Anchor Annotation, Paper 13
Score Point 4

There is evidence in this response that the student has a complete and thorough understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The response is complete and correct with an accurate explanation for why an unpainted bridge would be weakened most rapidly (because nothing is keeping the iron and oxygen separated, resulting in nothing hindering the reaction), and why a bridge in Florida would weaken faster than one in Alaska (because of the warmer weather. Warmer weather allows the reaction to take place faster because the molecules will be moving quicker). The conclusion, which is provided in the final sentence (Therefore, an unpainted bridge in Florida would be weakened most rapidly by oxidation), is completely supported by the accurate and coherent information that precedes it.

A14

The unpainted iron bridge in Florida would most rapidly weaken due to oxidation. There are two factors that would attribute to the oxidation, one being the lack of paint on the bridge. This easily exposes the raw iron to oxygen, speeding up oxidation. The other factor influencing the reaction is the warm, moist air of Florida. Not only does the air have the ability to carry oxygen molecules, but the warmth is also a catalyst, which speeds up the reaction. Comparing this to the cool, dry air in Alaska, the unpainted bridge there would not weaken as fast, along with the other painted bridges in Florida and Alaska.

Anchor Annotation, Paper 14
Score Point 4

There is evidence in this response that the student has a complete and thorough understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The response is complete and correct with an accurate assertion that the unpainted bridge in Florida would weaken most rapidly. The explanation for why an unpainted bridge would weaken most rapidly is correct (lack of paint on the bridge. This easily exposes the raw iron to oxygen, speeding up oxidation), as is the information for why a bridge in Florida would weaken faster than one in Alaska (warm, moist air of Florida. Not only does the air have the ability to carry oxygen molecules, but the warmth is also a catalyst, which speeds up the reaction). The error of describing the warm air as a "catalyst" is considered irrelevant and does not detract from the overall accuracy and thoroughness of the response.

The unpainted iron bridge in Florida would probably be the most rapidly weakened by the processes of oxidation. This is because, of course, the paint of a painted bridge would act as an insulator or barrier between the iron and oxygen, suggesting that the painted bridges in Florida and Alaska could likely be ruled out – they do not expose the iron bridges to oxidation like the unpainted bridges would. Then, it can be determined that the Florida unpainted bridge would be the most rapidly weakened as opposed to the unpainted Alaska bridge because temperature is a factor that affects the speed of particles. Oxygen atoms in the air, due to their gas form, are more likely to collide with each other and surrounding structures (i.e.: the unpainted bridge) as a result of higher temperatures. The higher the temperature, the faster the oxygen atoms will move and collide, leading them to more rapidly oxidize the iron in a bridge. Therefore, since Florida temperatures tend to be higher than Alaskan temperatures, it can be concluded that the unpainted Florida bridge would weaken from oxidation the most rapidly.

Anchor Annotation, Paper 15
Score Point 4

There is evidence in this response that the student has a complete and thorough understanding of how to determine which bridge would probably be weakened most rapidly by oxidation based on the factors influencing reaction rates. The response is complete and correct with an accurate assertion that the unpainted bridge in Florida would probably weaken most rapidly. The explanation for why an unpainted bridge would weaken most rapidly as a result of oxidation is correct (the paint...would act as an insulator or barrier between the iron and oxygen), thorough, and synthesized to rule out a painted bridge in either state (suggesting that the painted bridges in Florida and Alaska could likely be ruled out-they do not expose the iron bridges to oxidation like the unpainted bridges would). The explanation supporting the unpainted Florida bridge is also correct and thorough (temperature is a factor that affects the speed of particles. Oxygen atoms in the air, due to their gas form, are more likely to collide with each other and surrounding structures [i.e.: the unpainted bridge] as a result of higher temperatures. The higher the temperature, the faster the oxygen atoms will move and collide, leading them to more rapidly oxidize the iron in a bridge). The conclusion provided in the final sentence (Therefore, since Florida temperatures tend to be higher than Alaskan temperatures, it can be concluded that the unpainted Florida bridge would weaken from oxidation the most rapidly) is supported by the accurate and thorough information that precedes it.

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