MEAP 2000 HST SCIENCE
Rubric Question 15

15 (2 points) Two out of the three students lost weight during this experiment. Identify two reasons other than skipping breakfast that could account for weight loss in these two students.

KEY ELEMENTS:

- They may have eaten less food at other meals and snacks.
- They may have been more physically active than usual;
- They may have experienced mental illness.
- They may have experienced physical illness.
- They may have gained or lost body fluids/water (e.g. menstruation).
- Small sample size and random variation may have influenced the outcome.
- Their metabolism may have changed (e.g. higher metabolism or thyroid condition).
- They may have taken medication.
- Different scales may have been used for the different weight calculations.
- They may have drank more water during the 3-week period.
- The weight of their clothes may not have been-taken into consideration.
- The students may have been weighed at different times of day or under different situations.
- Any reason which displays a lack of control of the variables in the investigation.

* Students who give reasons such as “healthier diet” or “change in diet” must identify how the diet has changed. (e.g. a *reduced* amount of fat, *less* caloric intake, etc.)

SCORE POINTS:
2 points = 2 key elements
1 point = 1 key element
0 points = incorrect response

15 Water weight could have been lost (not a part of skipping breakfast). It's natural depending on the intake of fat, the weather, time of the month, etc.

If the student could have eaten less junk food, been on a diet, increased exercise - there wasn't a control so we don't know if they did these things).

G3

Score Point: 2

This response includes three key elements (water weight could have been lost, eaten less junk food, increased exercise).

15 These two students might have been very active, excercise wise those three weeks. They could have also changed their diets. They might have decided to eat healthier or their breakfast was a really fatty meal so when they stopped eating it, they lost weight.

G6

Score Point: 1

This response includes one key element (...might have been very active).

15 One of the reasons the students could have lost weight, other than skipping breakfast is that they may have similar metabolism rates than the other students they also could have been less hungry than the other student, which would result in weight loss

G7

Score Point: 0

This response does not include any valid key elements. The first reason (may have *similar* metabolism rates) does not show a lack of control in the investigation. The second reasort (less hungry) is too vague.

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Rubric Question 16

16 (2 points) A scientist might complain that this investigation "lacks a control."

- How could you change the experiment to give it a control?
- Why is it necessary to have a control?

KEY ELEMENTS:

<u>To add a control</u>

A. There should be two groups of students one group skips breakfast, the other does not.
   OR
B. The same group of students could be used in a second 3 week period of observation during which they do eat breakfast.
   OR
C. Make sure all students eat similar diets or get similar amounts of exercise (direct control of variables).

<u>Why a control is necessary</u>

A control is necessary to ensure that factors other than skipping breakfast are NOT responsible for the observed weight loss;
OR
To have something with which to compare the experimental group.
OR
A control strengthens the experiment by making the results more accurate.

SCORE POINTS:

2 points = 2 key elements
1 point = 1 key element
0 points = incorrect response

16 I would have chosen students with similar heights, weights, gender, and activity levels. Also, a controlled diet should have been used so no student ate more than the other. This way, the variables of the experiment would have been the same and the data would have been more conclusive.

G2

Score Point: 2

This response receives credit for controlling heights, weights, gender, and activity levels, as well as including a controlled diet. It also recognizes that a control is needed to have data that's more conclusive.

16 One way to have a control would be to use students that are about the same weight and same life style. Then have one of them continue with their life style and the others act differently. It is necessary to have a control because a control is what change is based on.

G4

Score Point: 1

This response receives partial credit for suggesting a control (have one of them continue with their lifestyle and the others act differently). The explanation for the control lacks understanding of why it is necessary.

16 The Scientist needs one thing that is constant through the whole experiment, called the Control. He could take one of his variables and set it at a constant temperature and condition.

G8

Score Point: 0

This response is too vague in its suggestions and receives no credit.

MEAP 2000 HST SCIENCE
Rubric Question 31

31 Compare and contrast physical and chemical changes. In your response, describe two similarities and two differences.

KEY ELEMENTS:

Similarities

Both kinds, of change involve a transfer of energy.

A **OR**

In both kinds of change, energy is either added or released.

OR

Both use/require energy.

B Both kinds of change may alter the appearance of a substance.
(both are visible changes, both look different, both may be a change in the state of matter)

C In both kinds of change, matter is neither created nor destroyed.

NOTE: It is insufficient for student to state very general similarities such as "both involve matter" or "both are changes."

Differences

No new substance is. formed in physical change.

A **OR**

New substance is formed/chemical reaction occurs in chemical change.

Energy transfer is usually greater in chemical change.

B **OR**

Less energy is usually transferred in physical change.

Energy is usually applied for physical change to occur.

C **OR**

Energy is usually released when chemical change occurs.

D Reactants can't be separated by physical means following a chemical change.
Note: Physical change is reversible/chemical change is permanent receives no credit unless an example is given to prove this statement true.

Physical change does not involve a change in properties (chemical composition).

E **OR**

Chemical change involves a change in properties (chemical composition.).

F Physical change involves a change in. state (phase) or appearance only.

G Chemical change is at the atomic/molecular level.

NOTE: Inter vs. Intra Molecular Bonding (Physical/Chemical) is an acceptable difference.
Inner change vs. outer change (inside change/outside change) is too vague to receive credit as a difference.
Examples of physical or chemical changes (by themselves) do not receive credit.

Score Points:
3 points = 3 or 4 key elements (must be at least one similarity and one difference)
2 points = 2 key elements (can be only differences or only similarities)
1 point = 1 key element
0 points = incorrect response

31 In both physical and chemical changes, energy is released and the substance changes its appearance. However, in a physical change, the substance only changes state, while in a chemical change the substance changes into something new. Physical changes have the same molecular structure, , while chemical changes require a rearrangment of molecules.

Score Point: 3

This response includes two similarities (both release energy and change appearance) and three differences (in a physical change the substance only changes state, in a chemical change it becomes something new, and chemical change occurs at a molecular level—rearranges the molecules).

31 Chemical changes are different from physical changes because they change the chemical make-up of the reactant. Physical changes deal with changing things like color, shape, mass, and volume. They are similar in that they both do do some sort of change to the substance. Also both processes can be reversed.

Score Point: 2

This response includes two differences (chemical changes change the make-up/chemical composition of the reactant/original substance and physical changes change the appearance) and no valid similarities.

31 Physical change is different from chemical because physical you aren't changing the actual chemical structure of anything & if chemical change you are, and

they are the same because they are both associated with science and they are bothing changing things.

Score Point: 1

This response includes one difference (in a physical change you aren't changing the chemical structure/composition and in a chemical change you are) and no valid similarities.

31 Physical change occurs when an action happens that makes a physical change happen. But a chemical change occurs when two things put or fused together as one.

Score Point: 0

This response includes neither similarities nor differences. It is too vague to merit credit.

MEAP 2000 HST SCIENCE
Rubric Question 32

GLOBAL WARMING

Carbon dioxide levels have increased in recent years, according to figures provided in a report given Wednesday night at a meeting of the Astronomical Society. Some scientists believe increased carbon dioxide levels are responsible for warmer temperatures worldwide over the past 10 years. Yet this global warming trend is far from dramatic, and the effect of increased carbon dioxide levels in Earth's atmosphere remains disputed.

Astronomers speaking at a local chapter meeting of the Astronomical Society cited studies of neighboring planets as evidence in support of the so-called greenhouse effect. The researchers cited Venus as a planet exhibiting extreme planetary warming. Venus has an atmosphere made up of more than 96 percent carbon dioxide. Its surface temperature is about 850°F, far hotter than expected based on its distance from the sun. The researchers voiced warnings that substantial releases of carbon dioxide into Earth's atmosphere could produce a warming trend of similar magnitude.

32 Some astronomers question using Venus as a model to predict how increased carbon dioxide levels in Earth's atmosphere will affect our planet. Describe three differences between Earth and Venus that might cause astronomers to question whether global warming data from Venus can be applied to earth.

KEY ELEMENTS:

- Venus has no liquid water (i.e., bodies of water or surface water).
- Venus has no (evidence of) life.
- Earth has been altered by life forms (man).
- Venus has had a different geologic history than Earth (has a different concentration of elements).
- The planets have a different chemical make-up.
- Venus is closer to the sun than Earth is (Venus and Earth are different distances from the sun).*
- Venus' period of rotation is different from Earth's.
- The atmosphere of Venus is different from Earth (Earth has more oxygen).
- *Venus is farther from the sun than Earth — receives no credit.

SCORE POINTS:
2 points = 3 key elements
1 point = 1 or 2 key elements
0 points = incorrect response

32 The differences between earth and venus would be that ① Venus is alot closer to the sun; ② Venus has none of the things we have here on earth to show proof such as trees, humans, etc. ③ Venus has a different atmosplere than we do, which is a totally different experiment and will not prove that the green house effect will make us like Venus.

Score Point: 2

33 This response includes three key elements (Venus is closer to the sun, has no life forms, and has a different atmosphere).

32 Earth & Venus have many differences that might cause scientists to question the application of Data from Venus to data from Earth. ① Earth and Venus are completly different distances from the sun and therefore have different temperatures. ② Earth and Venus are different sizes ③ Earth and Venus have different chemical makeups.

Score Point: 1

This response includes two key elements (different distances from the sun and different chemical make-up).

MEAP 2000 HST SCIENCE
Rubric Question 33

33 Some scientists have concluded that increased carbon dioxide levels in the atmosphere are responsible for the recent global warming trend. Give two reasons why other scientists may be reluctant to agree with this conclusion.

KEY ELEMENTS:

- A ten year study does not provide enough evidence to know for sure if earth is experiencing global warming (too short a time to know if this is true).
- Warming may be part of a larger pattern or cycle.
- It's the ozone layer that is responsible for global warming.
- Factors other than increased carbon dioxide levels in the atmosphere (e.g. weather patterns) could be contributing to global warming. *
- Global weather patterns are too complicated to conclude that the warming trend is only due to carbon dioxide levels.
- Comparisons to other planets are not necessarily valid.
- Some scientists might not agree with the scientific techniques used.
- Some scientists believe the average temperature shows a cooling trend, not warming.
- The student may receive full credit for specifying two other factors AND explaining them.

SCORE POINTS:

2 points = 2 key elements
1 point = 1 key element
0 points = incorrect response

32 I think that Venus is a planet that we really don't know much about / Earth well we do know about Earth.

Score Point: 0

This response gives one incorrect difference between Earth and Venus (we don't know much about Venus).

33 Some scientists may be reluctant to agree because they might think that what happens outside the earth's atmosphere wouldn't affect earth. There is also nothing proven that it has affected any other planet so why would it affect earths atmosphere.

Score Point: 1

This response includes one key element (nothing proven it has affected other planets).

33 Venus' atmosphere is made of of 96 percent CO_2 and is much hotter than Earth. Also the increase in CO_2 is directly proportional to the increase in Earth's temperature.

Score Point: 0

This response focuses on the misconception that carbon dioxide is the cause of global warming.

33 One reasons scientists might disagree with the idea that the increased CO_2 in the atmosphere is the cause of global warming is that there are other chemicals being released which are destroying the ozone layer other than CO_2. Another reason might be the idea that instead of the increase in CO_2, scientists may be more worried about the decrease in Oxygen amounts, which could also be a cause of global warming.

Score Point: 2

This response includes two key elements (other chemicals destroying the ozone layer and a decrease in oxygen amounts).