Science Reasoning Test Video Problems

Data Representation Problem Set

In many bicycles, a series of front and rear gears are coupled. Each gear is composed of a number of teeth. The gears are used to increase or decrease the force generated by the bicycle and, as a consequence, to increase or decrease the resulting speed of the bicycle. The Speed Advantage (SA) of a bicycle, the number of times a machine multiplies the speed, is defined as SA = number front teeth/ number rear teeth. The Mechanical Advantage (MA) of a bicycle, the number of times a machine multiplies the force, is defined as MA = number rear teeth/number front teeth.

The following table shows the relationship between the number of teeth in the front gears, rear gears, and the resulting SA and MA.

Front gears	Rear gears	SA	MA
50	10	5.00	0.20
50	20	2.50	0.40
50	30	1.67	0.60
50	35	1.43	0.70
50	40	1.25	0.80
40	10	4.00	0.25
40	20	2.00	0.50
40	25	1.60	0.63
40	30	1.33	0.75
40	35	1.14	0.88

1. Which gear combination produced the greatest mechanical advantage?

   A. Front 50, Rear 35
   B. Front 50, Rear 40
   C. Front 40, Rear 30
   D. Front 40, Rear 35

2. Which of the following expresses the relationship between speed advantage and mechanical advantage?

   F. As SA increases, MA increases
   G. As SA increases, MA decreases
   H. As SA increases, MA increases and then decreases
   J. There is no direct relationship

3. The smallest speed advantage in the table is produced by which of the following differences between the number of teeth in front gears and rear gears?

   A. 5
   B. 10
   C. 15
   D. 20

4. Front gears with 50 teeth and rear gears with 15 teeth would produce which of the following SA and MA?

   F. SA = 3.33, MA = 0.30
   G. SA = 2.00, MA = 0.30
   H. SA = 3.33, MA = 0.50
   J. SA = 2.00, MA = 0.50

5. A speed advantage of 1.00 would be associated with which of the following mechanical advantages?

   A. MA = 0.90
   B. MA = 1.00
   C. MA = 1.10
   D. MA = 1.25

Research Summary Problem Set

A series of experiments was designed to determine to what extent different factors influence how pancreatic enzymes convert milk fat to fatty acids.

Experiment 1

Enzyme and substrate (milk) concentrations were held constant. Temperature was varied and the time required for fatty acids to be produced was measured (in minutes).

Temperature	Time
10^0C	40
30^0C	20
40^0C	5
50^0C	20
70^0C	40

Experiment 2

The substrate (milk) amount was held constant and at 40^0C and the concentration of enzymes was varied (in g/50 mL).

Enzyme Concentration	Time
0.1	40
0.4	20
0.7	5
1.0	5

Experiment 3

The enzyme concentration was held constant and at 40^0C and the amount of substrate (milk) was varied (in mL milk/mL water).

Substrate Concentration	Time
1/6	40
2/5	15
6/1	5
7/0	5

6. Which of the following conditions would produce the shortest time to complete a reaction of converting milk fat to fatty acids?

   A. Enzyme Concentration = .1
   B. Enzyme Concentration = .4
   C. Substrate Concentration =2/5
   D. Substrate Concentration = 7/0

7. From the conditions in Experiment 1, a temperature of 35^0 C would produce a time to complete the reaction of approximately how many minutes?

   F. 10
   G. 20
   H. 30
   J. 40

8. Which Experiment(s) can be used to indicate factors which influence the time it takes to convert milk fat to fatty acids?

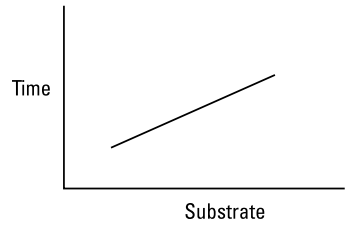
   A. Experiment I only
   B. Experiments II and III only
   C. Experiments I and III only
   D. Experiments I, II, and III

9. An enzyme concentration of 1.0 g/50 mL and a substrate concentration of 8/0 mL milk/mL water would produce a time to complete a reaction of approximately how many minutes?

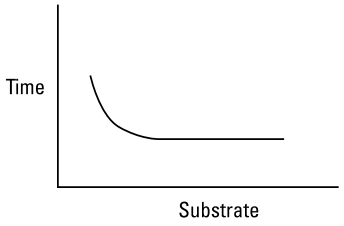
   F. 5
   G. 10
   H. 15
   J. 20

10. Which of the following is the best graphic representation of the data in Experiment 3?

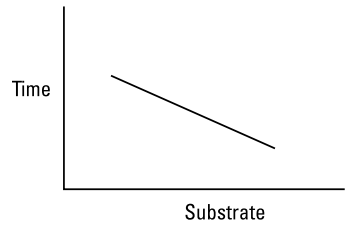
A.



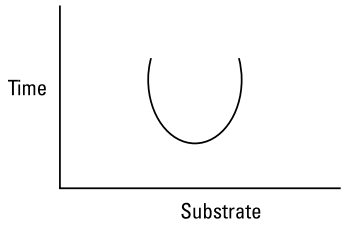
C.



B.



D.



11. In this series of Experiments, the researcher is making which of the following assumptions concerning the conversion of milk fat to fatty acids?

F. Temperature affects the reaction time
G. The concentration of substrate does not affect the reaction time
H. Enzyme concentration affects the reaction time
J. Only the variables of temperature, enzyme concentration, and substrate concentration affect reaction time

Conflicting Viewpoints Problem Set

Two scientists present their viewpoints on the causes for the extinction of the dinosaurs.

Scientist 1

Recent evidence indicates that the dinosaurs became extinct after the Earth collided with a huge comet or asteroid. The collision of this comet or asteroid with the Earth sent huge clouds of dust into the air. The dust remained suspended in the air for many months and lowered the surface temperature dramatically. The dinosaurs quickly froze to death.

The discovery in 1990 of a buried crater 112 miles in diameter, centered under a small town in the northern tip of Mexico's Yucatan peninsula, supports this theory. The age of this crater is 65 million years old, the same time frame in which the dinosaurs became extinct. As additional evidence, an analysis of the K-T boundary in the fossil record indicates a higher content of the rare element iridium than would be ordinarily found in the Earth's crust. Both comets and asteroids are rich with iridium.

Scientist 2

Although the theory that the dinosaurs became extinct when the Earth collided with a huge asteroid is intriguing, the evidence supporting it has many problems. For instance, the crater found in Mexico is actually too small: an asteroid only a mile across (not big enough to affect the whole Earth) could have produced the crater. Additionally, dust particles sent into the atmosphere by a collision would only have remained there a few days. Although comets and asteroids do contain a high content of iridium, the amount found in the K-T boundary is very small and could have been produced by numerous smaller collisions. Further evidence is needed before we can understand why the dinosaurs suddenly disappeared 65 million years ago.

12. The dinosaurs became extinct approximately

A. 55 million years ago.
B. 65 million years ago.
C. 100 million years ago.
D. 112 million years ago.

13. Which of the following pieces of evidence would support Scientist 1's position?

F. evidence of an asteroid collision 55 million years ago
G. amounts of iridium in other parts of the fossil record
H. research that dust particles can remain suspended in the air for months
J. evidence that the Earth's temperature didn't change dramatically

14. Which of the following pieces of evidence would weaken Scientist 2's position?

A. an asteroid 10 miles across produced the Mexican crater
B. dust particles from volcanoes remain in the atmosphere for two weeks
C. discovery of another crater in Mexico
D. evidence of other rare elements in asteroids

15. Scientist 1 and Scientist 2 agree about which of the following?

F. the amount of iridium in the K-T boundary
G. how long dust particles remain suspended in the air
H. how the dinosaurs became extinct
J. asteroids have collided with the Earth in the past

16. Both Scientist 1 and Scientist 2 would disagree with which of the following statements?

A. both comets and asteroids contain iridium
B. lowered surface temperatures caused the extinction of the dinosaurs
C. asteroids and comets have collided with the Earth
D. the dinosaurs became extinct through gradual evolutionary changes

