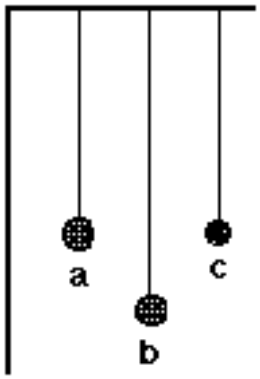
Name_____

Date_____ Pd____

Scientific Thinking in Experimental Settings Test



The data below were collected for three different pendulums. Answer the questions that follow based on the trends in the data.

	pendulum **a**	pendulum **b**	pendulum **c**
mass	20 g	20 g	10 g
length	50 cm	65 cm	50 cm
period for a 5º swing	0.76 sec	0.93 sec	0.76 sec
period for a 10º swing	0.76 sec	0.93 sec	0.76 sec

1. _____ In conducting the experiment, which of the following would make the best **dependent** variable?

A. mass B. length C. swing angle D. period

2. According to the data, how is the period of the pendulum affected by the mass of the pendulum bob?

3. According to the data, how is the period of the pendulum affected by the angle of the pendulum swing?

4. _____ You want to create a pendulum whose period is greater than that of pendulum **b**. Which of these changes must be made?

A. The new bob must be heavier than bob **b**.
B. The new string must be longer than the string for **b**.
C. The release angle for the new pendulum must be larger than for **b**.
D. All of these conditions must be present for a longer period.

5. The radius of the moon is approximately 1 350 000 m.

a) What is the radius of the moon in kilometers?

b) What is the radius of the moon in centimeters?

c) What is the radius of the moon in miles? (1 mile = 1600 meters)

6. A force is needed between the tires of a car and the road in order for the car to turn. The force needed depends on three variables:
   1) The force is directly proportional to the mass of the car.
   2) The force is directly proportional to the car's speed squared.
   3) The force is inversely proportional to the radius of the turn.

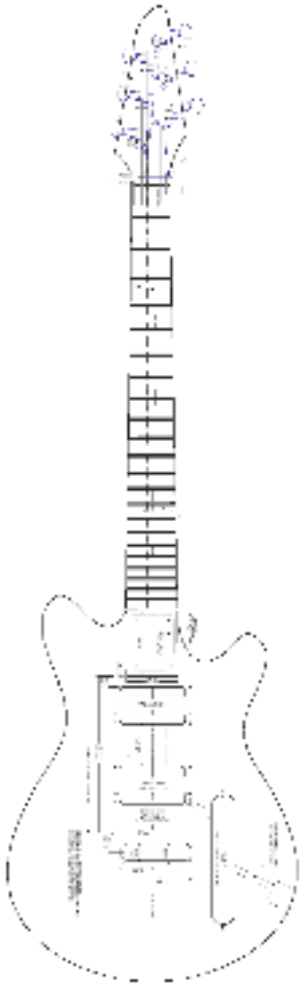
   a) If the mass of the car is doubled (by adding passengers and cargo) by what factor must the force change so the car can make the turn?

   b)If the speed of the car is doubled, by what factor must the force change so the car can make the turn?

   c) If the radius of the turn is doubled, by what factor must the force change so the car can make the turn?

   Bonus: Write a single equation relating force, mass, speed and radius based on the proportionalities given above.

A student noticed that thicker strings on a guitar produce lower notes. She measured the thickness of the strings and the vibration frequency (pitch) of the string when plucked. She tightened each string to the same tension, then plucked each string while measuring its pitch with a computer.



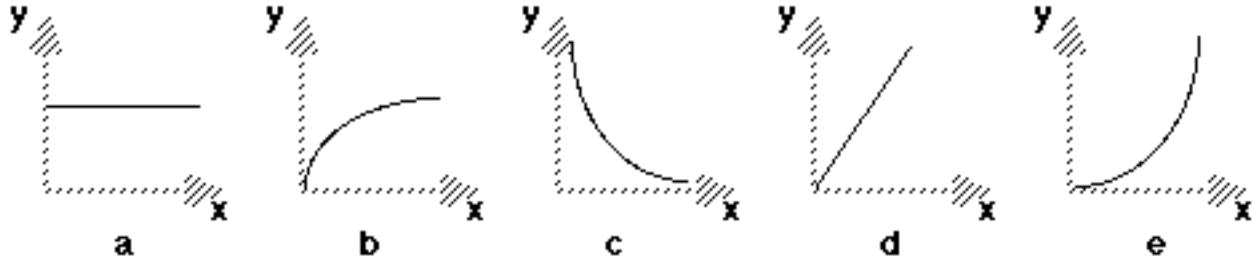
7. _____ What is the relationship being studied?
   A. How the string thickness affects the string tension.
   B. How the vibration frequency affects the pitch.
   C. How the string thickness affects the vibration frequency.
   D. How the string tension affects the vibration frequency.

8. _____ What is the dependent variable ?
   A. the string tension
   B. the the vibration frequency
   C. the length of the string
   D. the string thickness
   E. the pluck technique

9. _____ What is the independent variable?
   A. the string tension
   B. the the vibration frequency
   C. the length of the string
   D. the string thickness
   E. the pluck technique

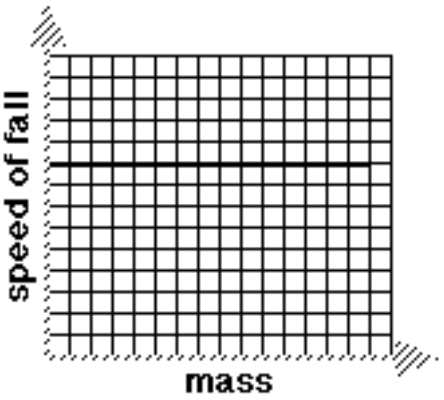
10. _____ What variables need to be kept constant during the investigation? (list all that apply)
   A. the string tension
   B. the the vibration frequency
   C. the length of the string that is free to vibrate
   D. the string thickness
   E. the pluck technique

In questions 11-15, match a letter from each of the following graphs with its corresponding graphical analysis statement.



11. _____ y = kx
12. _____ y is independent of x
13. _____ y vs. x^2
14. _____ y vs. 1/x
15. _____ y^2 vs. x

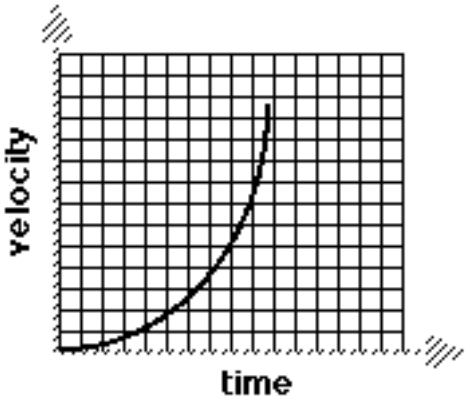
16. _____ For the graph on the right, the graphical representation between speed and mass could best be described as:



A. The speed of fall is directly proportional to the mass.
B. The speed of fall is proportional to the square root of the mass.
C. The speed of fall is inversely proportional to the mass.
D. The speed of fall is proportional to the square of the mass.
E. There is no relationship between the speed of fall and mass.

17. _____ The mathematical model for the graph above is best represented by
A. speed = k(mass)
B. $speed^2$ = k(mass)
C. speed = k(1/mass)
D. speed = $k(mass)^2$
E. speed = b

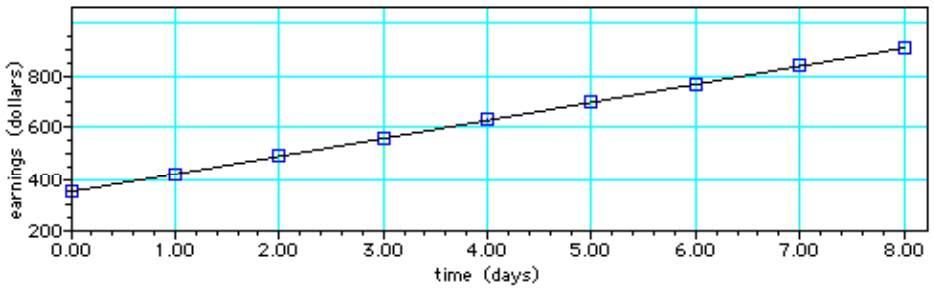
18. _____ For the graph on the right, the graphical representation between velocity and time is best stated by



A. Velocity is directly proportional to time.
B. Velocity is proportional to the square of time.
C. Velocity is inversely proportional to time.
D. Velocity is proportional to the square root of time.
E. There is no relationship between velocity and time.

19. _____ In an effort to create a straight line graph from the above data, you should
A. square the time values.
B. invert the time values.
C. square the velocity values.
D. invert the velocity values.
E. do nothing; you can't get a straight line out of this.

20. The following graph displays total earnings as a function of time.



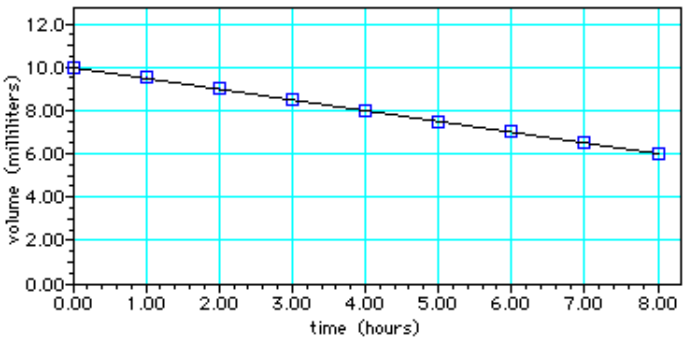
Slope	Y Intercept
70.0	350

a. Write an equation for the line.

b. Explain what the slope value of "70" means in this situation.

c. Provide an interpretation for the y-intercept of the line in this situation.

21. The graph below shows the amount of water remaining in a graduated cylinder as time passes and the water evaporates.



Slope	Y Intercept
-0.500	10.

a. Explain the meaning of the slope value "-0.500" as it pertains to this problem.

b. Write an equation for the graph, inserting variables and constants as appropriate.

c. Determine how much water will be left at time = 15 hours. You may use any method you want, but you must explain how you arrived at your answer.

22. An important equation for electric circuits is: Power = Resistance * Current^2

a. An experiment is done where the resistance is kept constant, the current is varied, and the resulting power is measured. Label the axes appropriately for such an experiment and sketch the shape of the expected graph.

BONUS! In a second experiment, Power is kept constant, the resistance is varied, and the resulting current is measured. Label the axes appropriately for such an experiment and sketch the shape of the expected graph.