

PHYSICS 1

Test #4

6 May 1999

Student's name _____ S.N. _____

Givens:

$$x = v \times t$$

$$v = a \times t$$

$$d = \frac{1}{2}a \times t^2$$

$$y = \frac{1}{2}g \times t^2$$

$$g = 10m/s^2$$

$$f d = \frac{1}{2}mv^2$$

$$PE = mgh$$

$$KE = \frac{1}{2}mv^2$$

$$\text{Torque} = \text{lever arm} \times \text{force}$$

$$F = G \frac{m_1 m_2}{d^2}$$

$$\text{fluid pressure} = \rho gh$$

$$f/a = F/A$$

$$fD = Fd$$

$$\text{wavelength} \times \text{frequency} = \text{speed}$$

$$F = k \frac{q_1 q_2}{d^2}$$

$$\text{voltage} = \text{energy}/\text{charge}$$

$$\text{current} = \text{voltage}/\text{resistance}$$

$$\text{Power} = \text{current} \times \text{voltage}$$

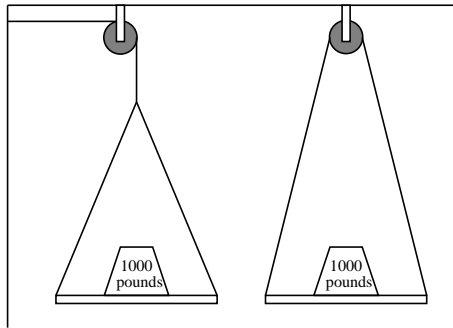
Unless noted otherwise, assume friction and air resistance are zero.

A. Short answer. Fill-in the blank. 2 points each.

1. If you drive to campus a distance of 20 miles in 30 minutes, your average speed in miles per hour (mph) is _____.
2. A car moving 20 miles per hour can be stopped in no less than 50 feet. What is the shortest distance for the car to stop if it was moving 40 miles per hour? _____.
3. Unlike water, where increasing depth leads only to increasing pressure, increasing depth in the atmosphere leads to an increase in both pressure and _____.
4. A negatively charged balloon is brought near an uncharged wall. Some electrons in the wall are pushed away, leaving the surface of the wall with a slight positive charge. This is an example of charge _____.
5. One coulomb of charge passing through a 9 volt battery gains _____ of energy.

B. True or false (correct if false). 2 points each.

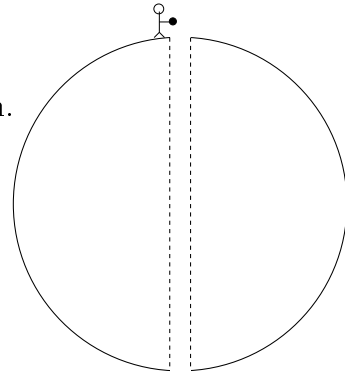
- ___ 1) In projectile motion, the minimum **speed** occurs at the apex (the highest point of the trajectory).
- ___ 2) In the picture below, the tensions in the ropes going through the pulleys is the same in both cases.



- ___ 3) A car design, in which the car will bounce very quickly off any object it happens to hit, is the safest design for passengers in the car.
- ___ 4) A car travels in a circle at constant speed. The net force on the car is zero because the car is not accelerating.
- ___ 5) As a building material, stone is stronger under tension than under compression.
- ___ 6) Galileo noticed that chandeliers in church oscillated with the same period, regardless of amplitude.
- ___ 7) Electric fields surround only positively charged objects.
- ___ 8) As an electron is brought near a proton, the electron loses potential energy.
- ___ 9) If you stretch a copper wire, making it longer and thinner, the resistance between the ends doesn't change.
- ___ 10) Compared to two resistors in series, the same two resistors in parallel have smaller resistance.

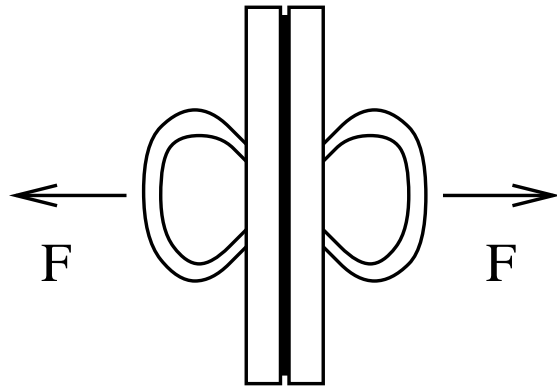
C. Multiple choice. Check the box of the correct answer. 2 points each.

1. What is the acceleration of a car that maintains a constant velocity of 100 km/h for 10 seconds?
 - a) 0.
 - b) 10 km/hr/s .
 - c) 10 m/s/s .
 - d) 1000 km/h/s .
2. A sack of potatoes weighing 200 N falls from an airplane. As the velocity increases, air resistance also increases. When air resistance equals 200 N , the sack's acceleration in meters per second per second is
 - a) 0.
 - b) 5.
 - c) 10.
 - d) infinite.
 - e) none of these.
3. If you dropped a stone into a hole drilled straight through a planet, the stone will
 - a) come to an abrupt stop at the center.
 - b) speed up until it reaches the center, then slow down.
 - c) speed up until it reaches the other side, then slow down.
 - d) slow down until it reaches the center.
 - e) none of these.



4. Hydrogen peroxide has a chemical form H_2O_2 . If you break up a quantity of hydrogen peroxide, you produce 1 liter of hydrogen gas (H_2). How many liters of oxygen gas (O_2) will you produce?
 - a) less than $1/2$ liter.
 - b) $1/2$ liter.
 - c) 1 liter.
 - d) 2 liters.
 - e) more than 2 liters.

5. Penn has a mass of 100 kg, while his friend Teller has a mass of only 50 kg. They are wearing identical (except for size) suits. Penn's suit requires
- more than twice as much material.
 - the same amount of material.
 - more material, but less than twice as much material.
6. Ice cubes submerged at the bottom of a liquid mixture indicate that the mixture
- fails to produce a buoyant force on the ice.
 - has dissolved air in a liquid state.
 - is composed of open-structured crystals.
 - is not displaced by the submerged ice.
 - is less dense than ice.
7. In lecture, we saw the effect of air pressure holding together two metal plates with a small evacuated region in between them. It would be harder to pull the plates apart when they are
- held upside down.
 - at sea level.
 - 20 km beneath the ocean surface.
 - 20 km above the ocean surface.
 - none of these.

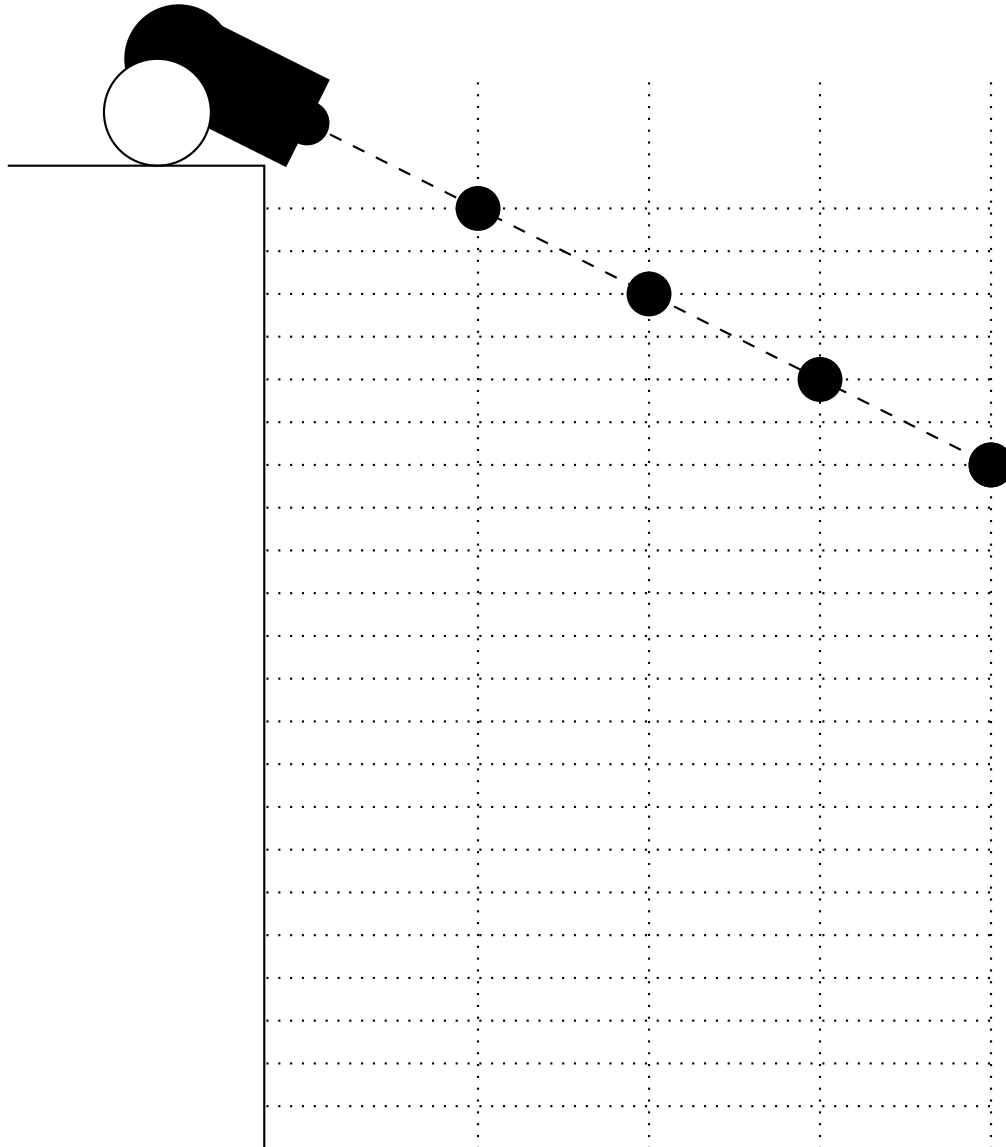


8. Unlike a transverse wave, a longitudinal wave has
- no amplitude.
 - no frequency.
 - no wavelength.
 - no speed.
 - ...a longitudinal wave has all of these.
9. A floating leaf oscillates up and down two complete cycles in one second as a water wave passes by. The wave's wavelength is 10 meters. What is the wave's speed?
- 2 m/s.
 - 10 m/s.
 - 20 m/s.
 - 40 m/s.
 - more than 40 m/s.

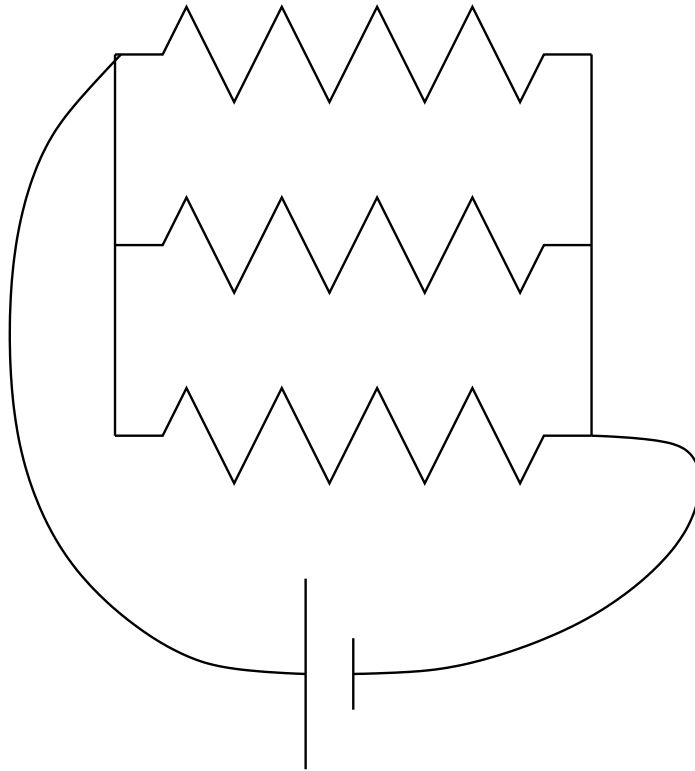
10. A Doppler effect occurs when a source of sound moves
- a) towards you.
 - b) away from you.
 - c) both of these.
 - d) neither of these.
11. The electrical forces between charges depends on the
- a) magnitude of electric charges.
 - b) separation between electric charges.
 - c) both of these.
 - d) neither of these.
12. When the distance between two charges is halved, the electrical force between the charges
- a) quadruples.
 - b) doubles.
 - c) remains unchanged.
 - d) is reduced by $1/2$.
 - e) is reduced by $1/4$.
13. Two charges placed near each other are released. As they move, the acceleration of each decreases. Therefore, the particles have
- a) the same sign charges.
 - b) opposite sign charges.
 - c) no electric charges.
 - d) not enough information is given.
14. A 60 Watt light bulb is connected to a 120 volt socket. What is the current in the light bulb?
- a) $1/4$ A.
 - b) $1/2$ A.
 - c) 2 A.
 - d) 4 A.
 - e) more than 4 A.
15. In an ac circuit, the electric field
- a) increases via the inverse square law.
 - b) changes magnitude and direction with time.
 - c) is everywhere the same.
 - d) is non-existent.
 - e) none of these.

D. Complete the pictures as requested. 10 points each.

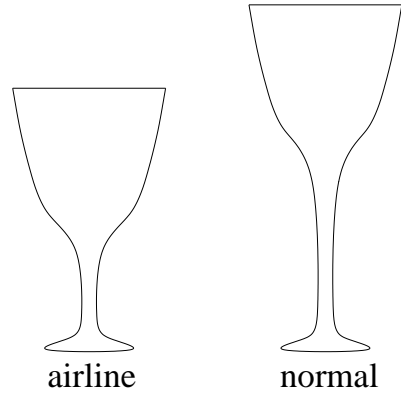
1. On the picture below, I show the path of the cannonball if gravity was turned off in 1 second intervals. Sketch the actual position of the cannonball assuming $g = 10m/s^2$; the horizontal, dotted lines are 5 meters apart.



2. In the following circuit, the 3 light bulbs (represented by the resistors) are in parallel. Remove 2 wires (put an X on them) to put the 2 light bulbs in series.



- E. Passengers flying first class are served wine in “real” wine glasses as part of the extra service. The wine glasses used by the airline have shorter stems than normal. Explain this in terms of a physics concept we recently discussed. 10 points.



F. Since sound waves require a medium, astronauts on the moon “talk” to each other using radio rather than sound waves. However, if one astronaut’s radio is broken, they can communicate with sound if they touch their helmets together. Explain what is happening here! 10 points.