

PHYSICS 1

Test #2

18 March 1999

Student's name _____ S.N. _____

Givens:

$$Work = F \times d$$

$$Power = W/t$$

$$PE = mgh$$

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

$$Torque = lever\ arm \times force$$

$$Angular\ momentum = I\omega = mvr$$

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

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{impulse} = \text{Force} \times \text{time} = \text{change in momentum}$$

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

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

1. Two identical balls are on a collision course. They are both moving with a speed of $1\ m/s$, but in opposite directions, before the collision. After an **inelastic** collision, what is the speed of the balls? _____
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. A space station is rotating to provide artificial gravity. You feel twice as heavy as you do on earth; how should you change the rotational speed of the station? (increase or decrease) _____
4. An object on earth weighs 20 pounds. A different object held stationary a distance of the earth's radius above the earth's surface feels a gravitational force of 5 pounds. How does the mass of the object in space compare to the mass of the object on earth?

5. How many protons are there in one atom of silver (Ag)? _____.

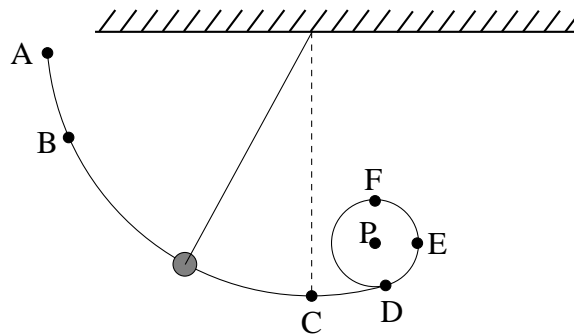
B. True or false (correct if false). 2 points each.

- _____ 1) 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.
- _____ 2) Momentum is a measure of an object's amount of motion.
- _____ 3) A karate expert, trying to break a board with her bare hands, wants her hand in contact with the board for as long a time as possible.
- _____ 4) The gravitational potential energy of an object depends only on how its height.
- _____ 5) Mechanical energy (kinetic + potential energy) is constant even if there is friction or air resistance.
- _____ 6) A bullet with kinetic energy of 100 J goes right through a block of wood. Afterwards, the bullet has 50 J of kinetic energy and the block has 20 J of kinetic energy. This is an example of an elastic collision.
- _____ 7) A car travels in a circle at constant speed. The net force on the car is zero because the car is not accelerating.
- _____ 8) Kepler found that planets orbiting the sun move in ellipses with the sun at one focus.
- _____ 9) High tides are exceptionally high during lunar or solar eclipses.
- _____ 10) H_2O is an example of both a molecule and an element.

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

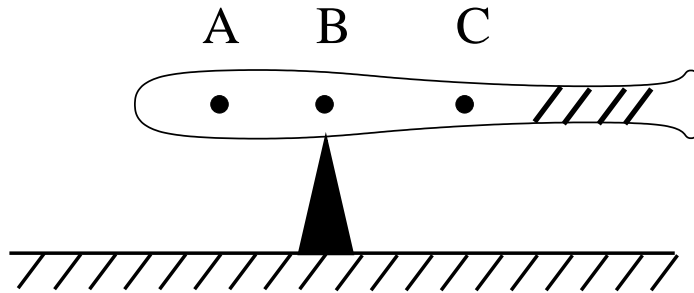
1. A heavy truck and a light truck roll down a hill. Neglecting friction and air resistance, at the bottom of the hill, which of the following properties will be different for the two vehicles?
 - a) momentum.
 - b) speed.
 - c) acceleration.
 - d) all of these.
 - e) none of these.
2. A 5 kg fish swimming at a velocity of 1 m/s swallows an absent-minded 1 kg fish moving at 2 m/s in the other direction. The speed of the larger fish after lunch is
 - a) $1/2\text{ m/s}$.
 - b) $1/3\text{ m/s}$.
 - c) $5/6\text{ m/s}$.
 - d) $6/5\text{ m/s}$.
 - e) $7/6\text{ m/s}$.
3. An object is raised above the ground gaining a certain amount of potential energy. If the same object is raised three times as high, it gains
 - a) nine times as much potential energy.
 - b) three as much potential energy.
 - c) the same amount of potential energy.
 - d) one third the potential energy.
 - e) one ninth the potential energy.
4. A small bead tied to a string swings without air resistance. Beginning from rest at point A , the string hits a nail at point P and the bead moves in the small circle. Considering only the 5 points B , C , D , E and F , the bead has minimum speed at point

- a) B .
- b) C .
- c) D .
- d) E .
- e) F .



5. Consider a lever. When one side of the lever is depressed 20 cm , the other side of the lever is observed to move 1 cm . With the same lever, an input force of 1 N can raise no more than
- 1 N .
 - 10 N .
 - 20 N .
 - 21 N .
6. You put a pipe over the end of a wrench when trying to turn a stubborn nut on a bolt, to effectively make the wrench handle twice as long. You'll increase the torque by
- two.
 - four.
 - eight.

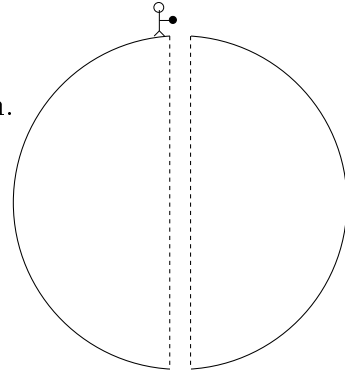
7. The baseball bat is balanced on the fulcrum. The center of gravity of the bat is at point
- A.
 - B.
 - C.



8. An car is driving in a circle. What provides the centripetal force?
- The car's engine.
 - The car's tires.
 - The car's weight.
 - There is no centripetal acceleration in this case.
9. Your instructor is on the rotating turntable. As he extends his arms, his rotational speed is cut in half. What happens to his rotational inertia?
- It doubles.
 - It remains the same.
 - It is cut in half.
 - Not enough information given.
10. You are riding an experimental elevator which accelerates downwards at 20 m/s^2 . You'd feel
- your normal weight, standing on the floor.
 - no weight, floating in the middle of the car.
 - your normal weight, standing on the ceiling.
 - your normal weight, standing on the left hand wall.

11. Consider two planets in space that gravitationally attract each other. If the distance between the planets is doubled, then the force of gravity between them
- a) increases by four.
 - b) doubles.
 - c) decreases to one half.
 - d) decreases to one quarter.
 - e) none of these.

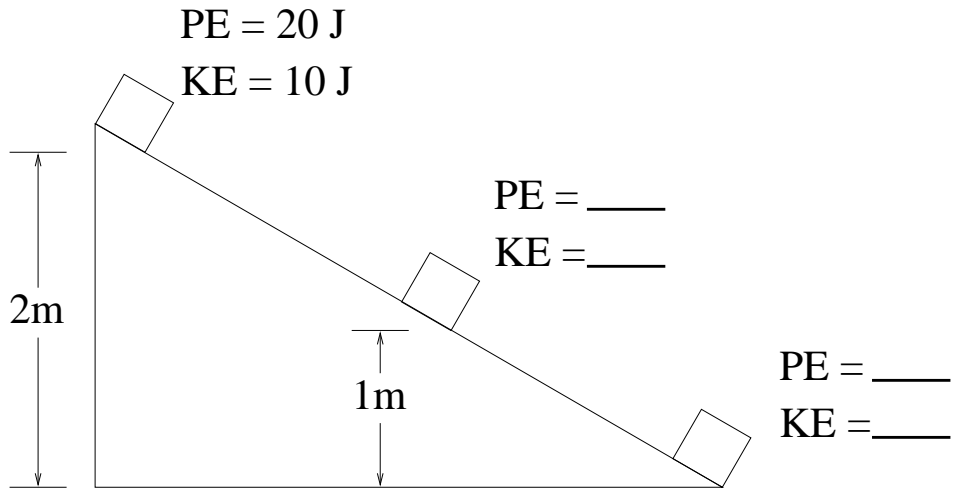
12. If you dropped a stone into a hole drilled straight through a planet, the stone will
- a) come to an abrupt stop at the center.
 - b) speed up until it reaches the center, then slow down.
 - c) speed up until it reaches the other side, then slow down.
 - d) slow down until it reaches the center.
 - e) none of these.



13. Which of these atoms has the most mass?
- a) tungsten (W).
 - b) lead (Pb).
 - c) boron (B).
 - d) radium (Ra).
 - e) all have the same mass.
14. 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.
15. If 2 protons are added to an oxygen (O) nucleus, the result is
- a) heavy oxygen.
 - b) flourine (F).
 - c) neon (Ne).
 - d) sodium (Na).
 - e) none of these.

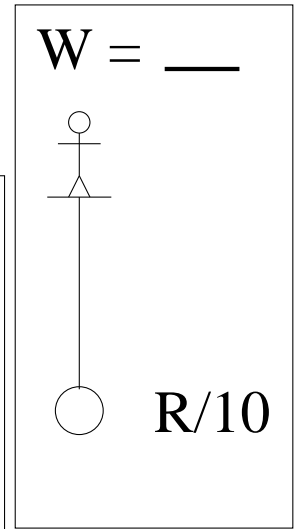
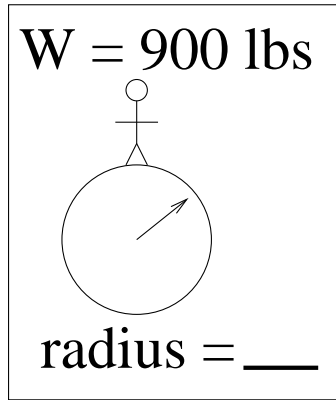
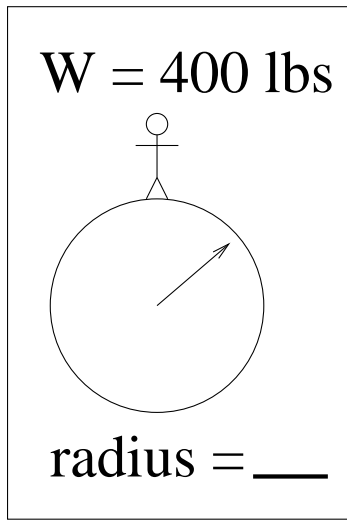
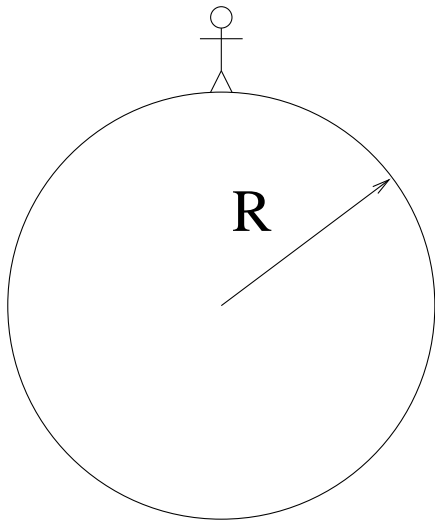
D. Complete the pictures as requested. 10 points each.

1. Fill in the Potential and Kinetic energies that are missing.



2. Fill in the radius or weight

$W = 100 \text{ lbs}$



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. 20 points.

