Physics 107: Ideas of Modern Physics

Exam 1
Sep. 28, 2005

Name______________________________________________________
ID #_________________________               Section #______________

On the Scantron sheet,
1) Fill in your name
2) Fill in your student ID # (not your social security #)
3) Fill in your section # (under ABC of special codes)

Fundamental constants:   \( g \) = accel. of gravity on Earth = 10 m/s\(^2\)
\( G \) = gravitational constant = 6.7x10\(^{-11}\) N-m\(^2\)/kg\(^2\)
1. A

2. The gravitational force exerted by the earth on 1 kg apple at the surface is
   a. 0 N
   b. 0.5 N
   c. 1 N
   d. 5 N
   e. 10 N

3. In the graph to the right, which of the following is negative
   a. velocity but not acceleration
   b. acceleration but not velocity
   c. both velocity and acceleration
   d. neither velocity nor acceleration
   e. not enough information to answer the question.

4. A Ferrari F50 can accelerate from 0 to 2.7 m/s (60 mph) in 3.8 sec. What is the average acceleration in terms of $g$, the acceleration of gravity?
   a. 0.05 g
   b. 0.07 g
   c. 0.11 g
   d. 0.13 g
   e. 0.21 g

5. The inertia of an object best describes its
   a. speed
   b. velocity
   c. acceleration
   d. momentum
   e. mass
6. A 1 kg ball moving at 2 m/s on a table collides with a stationary 2 kg ball. After the collision, the 2 kg ball is moving to the right on the table at 1.5 m/s. After the collision, the 1 kg ball is

a. moving to the right at constant speed
b. moving to the left at constant speed
c. accelerating to the right
d. accelerating to the left
e. stationary

7. An 60 kg scientist has has developed a jet pack with 1000 Newtons of thrust. If she uses it on earth, what is her acceleration upward?

a. 0 m/s²
b. 3.2 m/s²
c. 6.7 m/s²
d. 10 m/s²
e. 17 m/s²

8. Conservation of momentum says that

a. The momentum of an object can never change.
b. The momentum of an object can never decrease
c. Momentum can be transferred between objects, but does not disappear.
d. Momentum cannot be negative.
e. All of the above.
9. The figure at right shows an object in uniform circular motion. Which vector best describes the acceleration of the object at that point in its orbit?

   a. A  
   b. B  
   c. C  
   d. D  
   e. impossible to tell from the given information

10. I lift a 5 kg bowling ball from the floor to above my head at a constant speed of 0.5 m/s. The instantaneous net force on the ball at any point during the motion is

   a. 0 N  
   b. 2.5 N  
   c. 10 N  
   d. 12 N  
   e. 50 N

11. In outer space there are two large rocks with different masses, related by $M_{\text{big}} = 2M_{\text{small}}$. The same 10 Newton thrust is applied to each for 2 seconds and then shut off. The velocities when the thrust is turned off are related as:

   a. $v_{\text{big}} = 2v_{\text{small}}$  
   b. $v_{\text{small}} = 2v_{\text{big}}$  
   c. $v_{\text{big}} = 4v_{\text{small}}$  
   d. $v_{\text{small}} = 4v_{\text{big}}$  
   e. $v_{\text{big}} = v_{\text{small}}$
12. The acceleration of gravity on the moon is 6 times smaller than on earth. Identical apples are dropped from the same height on the Earth and the moon. Which of the following approximate answers best describes the velocity of the apple as it hits the moon’s surface?

   a. The same as the apple on Earth.
   b. 3 times less than the apple on Earth.
   c. 2.5 times less than the apple on Earth.
   d. 6 times less than the apple on Earth.
   e. 36 times less than the apple on Earth.

13. A racer floors his dragster from a stop at time=0, so that a constant force is applied to it for the entire race. Which of the following statements is true?

   a. Its speed is constant after a short time.
   b. Its speed increases proportional to time.
   c. Its speed increases proportional to time squared.
   d. Its speed increases proportional to the square root of time.
   e. Its speed varies chaotically.

14. An object is moving to the right in a straight line at a constant speed. Which one of the following statements best describes forces acting on it?

   a. No forces are acting on the object.
   b. A larger number of forces are acting on the object to the right than to the left.
   c. The net force acting on the object is to the right.
   d. Just one force is acting on the object.
   e. No net force is acting on the object.
15. Which of the following is **not** a system that can show chaotic behavior.

   a. Dripping water faucet.
   b. The weather.
   c. A driven pendulum.
   d. A fire hose.
   e. They can all show chaotic behavior.

16. Hoover dam produces electrical power from water dropping a vertical distance of 200 meters. This water flows at a rate 20,000 gal/sec (=750,000 kg/s). Assuming that energy of the falling water is converted entirely to electrical power, what is the power output of the dam?

   a. 7.5 million watts
   b. 40 million watts
   c. 750 million watts
   d. 1500 million watts
   e. 3000 million watts

17. In class, a brave physics professor did not flinch when a bowling ball pendulum swung to within millimeters of his nose, because it swung back exactly to its release position. This illustrated the

   a. conservation of energy
   b. principle of superposition
   c. conservation of momentum
   d. principle of inertia
   e. stupidity of the professor
18. In outer space, an astronaut applies a 5 Newton force to a 2 kg object for 5 meters. How much work did the astronaut do?

a. 10 Joules  
b. 25 Joules  
c. 50 Joules  
d. 100 Joules  
e. 250 Joules

19. Two people use ropes to pull identical sofas up to their neighboring 5th floor apartments. One pulls up the sofa gradually in 100 seconds. The other pulls theirs up quickly in 20 seconds. The power output and the work done of the quick puller compares to that of the slow puller as

a. Work same, Power same  
b. Work same, Power greater  
c. Work greater, Power same  
d. Work greater, Power greater  
e. none of the above.

20. Two stones of different masses are released from rest at the same height, but one of them one second after the other. Which of the following is true?

a. The difference in their speeds is constant.  
b. They hit the ground one second apart.  
c. There is a constant distance between them.  
d. The difference in their accelerations increases as they fall.  
e. All of the above.

21. Two people standing still on roller blades start throwing a ball back and forth. After a couple of throws, they are (ignoring friction)

a. standing still at their initial locations.  
b. standing still farther from each other.  
c. standing still closer together.  
d. moving toward each other.  
e. moving away from each other.