

# Physics 107: Ideas of Modern Physics

Exam 1  
Sep. 27, 2006

Name \_\_\_\_\_

ID # \_\_\_\_\_ Section # \_\_\_\_\_

**On the Scantron sheet,**

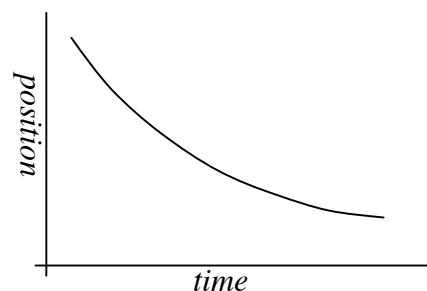
- 1) Fill in your name
- 2) Fill in your student ID # (not your social security #)
- 3) Fill in your section # (under ABC of special codes)

Fundamental constants:  $g = \text{accel. of gravity on Earth} = 9.81 \text{ m/s}^2$   
 $G = \text{gravitational constant} = 6.7 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$

1. A

2. 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.



3. An object moves 20 m east in 30 s and then returns to its starting point taking an additional 50 s. If west is chosen as the positive direction, what is the sign associated with the average velocity of the object?

- a. +
- b. -
- c. 0 (no sign)
- d. any of the above
- e. none of the above

4. A bird, accelerating from rest at a constant rate, experiences a displacement of 28 m in 11 s. What is its acceleration?

- a.  $0.21 \text{ m/s}^2$
- b.  $0.46 \text{ m/s}^2$
- c.  $0.64 \text{ m/s}^2$
- d.  $0.78 \text{ m/s}^2$
- e.  $1.00 \text{ m/s}^2$

5. A 50-g ball traveling at 25.0 m/s is bounced off a brick wall and rebounds at 22.0 m/s. A high-speed camera records this event. If the ball is in contact with the wall for 0.0035 s, what is the average acceleration of the ball during this time interval?

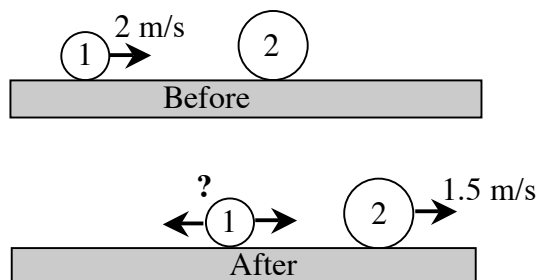
- a.  $13\,400 \text{ m/s}^2$
- b.  $6\,720 \text{ m/s}^2$
- c.  $857 \text{ m/s}^2$
- d.  $20 \text{ m/s}^2$
- e.  $47 \text{ m/s}^2$

6. The inertia of an object best describes its

- a. speed
- b. velocity
- c. acceleration
- d. momentum
- e. mass

7. 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



8. A baseball catcher throws a ball vertically upward and catches it in the same spot when it returns to his mitt. At what point in the ball's path does it experience zero velocity and non-zero acceleration at the same time?

- a. midway on the way up
- b. at the top of its trajectory
- c. the instant it leaves the catcher's hand
- d. the instant before it arrives in the catcher's mitt
- e. before the catcher throws the ball

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

- a.  $0 \text{ m/s}^2$
- b.  $3.2 \text{ m/s}^2$
- c.  $6.9 \text{ m/s}^2$
- d.  $10 \text{ m/s}^2$
- e.  $17 \text{ m/s}^2$

10. An astronaut applies a force of 500 N to an asteroid, and it accelerates at  $7.00 \text{ m/s}^2$ . What is the asteroid's mass?

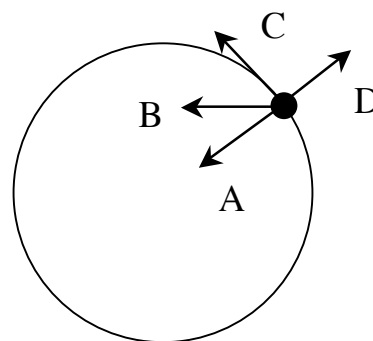
- a. 71 kg
- b. 135 kg
- c. 441 kg
- d. 500 kg
- e. 3500 kg

11. 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.

12. 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



13. The acceleration due to gravity on the Moon's surface is one-sixth that on Earth. An astronaut's life support backpack has a mass of 300 kg on Earth. What is the backpack's mass on the Moon?

- a. 1 800 kg
- b. 300 kg
- c. 135 kg
- d. 50 kg
- e. none of the above

14. Somewhere between the Earth and the Moon is a point where the gravitational attraction of the Earth is canceled by the gravitational pull of the Moon. Which of the following statements is true about this point.
- The point is closer to the earth
  - The point is closer to the moon
  - The point is halfway between the earth and the moon
  - There is no such point
  - All of the above statements are false
15. 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?
- No forces are acting on the object.
  - A larger number of forces are acting on the object to the right than to the left.
  - The net force acting on the object is to the right.
  - Just one force is acting on the object.
  - No net force is acting on the object.
16. A rock is thrown straight up with an initial velocity of 15.0 m/s. Ignore energy lost to air friction. How high will the rock rise?
- 1.53 m
  - 22.9 m
  - 6.50 m
  - 11.5 m
  - 15.0 m
17. 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?
- 7.5 million watts
  - 40 million
  - 750 million watts
  - 1500 million watts
  - 3000 million watts

18. In class, a brave physics professor did not flinch(much) 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

19. In outer space, an astronaut applies a 6 Newton force to a 2 kg object for 5 meters. How much work did the astronaut do?

- a. 12 Joules
- b. 30 Joules
- c. 60 Joules
- d. 120 Joules
- e. 240 Joules

20. Two people use ropes to pull identical sofas up to their neighboring 5<sup>th</sup> 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.

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.