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Hovercraft

Division C

Score: \_\_\_\_\_\_\_\_\_\_\_\_/60

Hovercraft - Division C

Answer Sheet

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Hovercraft - Division C

Written Exam

Part I: Multiple Choice

Each correctly answered question is worth 1 point.

Write the letter that corresponds to your answer to each question on the answer sheet.

**Responses not recorded on the answer sheet will not be graded.**

1. A rubber ball and a lump of putty have equal mass. They are thrown with equal speed against a wall. The ball bounces back with nearly the same speed with which it hit. The putty sticks to the wall. Which objects experience the greater momentum change?
   1. The ball
   2. The putty
   3. Both experience the same momentum change.
   4. Cannot be determined from the information give.
2. How is the smoke drawn up a chimney affected when there is a wind blowing outside?
   1. Smoke rises more rapidly in the chimney
   2. Smoke is unaffected by the wind blowing
   3. Smoke rises more slowly in the chimney
   4. Smoke is forced back down the chimney
3. An object moving in the +x axis experiences an acceleration of +2.0 m/s2. This means the object is:
   1. Traveling at 2.0 m in every second.
   2. Traveling at 2.0 m/s in every second.
   3. Changing its velocity by 2.0 m/s.
   4. Increasing its velocity by 2.0 m/s in every second.
4. An Olympic athlete throws a javelin at four different angles above the horizontal with the same speed. Which two throws cause the javelin to land the same distance away?
   1. 30 & 80-degrees
   2. 40 & 60-degrees
   3. 40 & 80-degrees
   4. 30 & 60-degree
5. If you exert a force F on an object, the force which the object exerts on you will
   1. Depend on whether or not the object is moving.
   2. Depend on whether or not you are moving.
   3. Depend on the relative masses of you and the object
   4. Always be F
6. In the absence of an external force, a moving object will:
   1. Stop immediately
   2. Slow down and eventually come to a stop
   3. Go faster and faster
   4. Move with constant velocity.
7. A small car meshes with a large truck in a head-on collision. Which of the following statements concerning the magnitude of the average collision force is correct?
   1. The truck experiences the greater average force.
   2. The small car experiences the greater average force.
   3. The small car and the truck experience the same average force.
   4. It is impossible to tell since the masses and velocity are not given.
8. The acceleration of an object is inversely proportional to
   1. The net force acting on it
   2. Its position
   3. Its velocity
   4. Its mass
9. A ping-pong ball moving east at a speed of 4 m/s, collides with a stationary bowling ball. The ping-pong ball bounces back to the west, and the bowling ball moves very slowly to the east. Which object experiences the greater magnitude impulse during the collision?
   1. Neither; both experienced the same magnitude impulse.
   2. The ping-pong ball
   3. The bowling ball
   4. It’s impossible to tell since the velocity after the collision are unknown.
10. A rocket moves through empty space in a straight line with constant speed. It is far from the gravitational effect of any star or planet. Under these conditions, the force that must be applied to the rocket in order to sustain its motion is
    1. Equal to its weight
    2. Equal to its mass
    3. Dependent on how fast it is moving.
    4. zero.
11. Objects A and B both start from rest. They both accelerate at the same rate. However, object A accelerates for twice the time as object B. What is the distance traveled by object A compared to that of object B while they’re accelerating?
    1. The same distance.
    2. Twice as far.
    3. Three times as far.
    4. Four times as far
12. Suppose a ball is thrown straight up. Make a statement about the velocity and the acceleration when the ball reaches the highest point:
    1. Both its velocity and its acceleration are zero.
    2. Its velocity is zero and its acceleration is not zero.
    3. Its velocity is not zero and its acceleration is zero.
    4. Neither its velocity nor its acceleration is zero.
13. An object floats in water with ¾ of its volume submerged. What is the ratio of density of the object to that of water?
    1. ¼
    2. ⅓
    3. ¾
    4. 4/3
14. Two objects are thrown from the top of a tall building. One is thrown up and the other is thrown down, both with the same initial speed. What are their speeds when they hit the street?
    1. The one thrown up is traveling faster.
    2. The one thrown down is traveling faster.
    3. They are traveling at the same speed.
    4. It is impossible to tell because the height of the building is not given.
15. Action-Reaction forces
    1. Sometimes act on the same object
    2. Always act on the same object
    3. May be at right angles
    4. Always act on different objects
16. A pilot drops a bomb from a plane flying horizontally at a constant speed. Neglecting air resistance, when the bomb hits the ground the horizontal location of the plane will:
    1. be behind the bomb.
    2. be over the bomb.
    3. be in front of the bomb.
    4. depend on the speed of the plane when the bomb was released.
17. When a cannon fires a cannonball, the cannon will recoil backward because the
    1. Energy of the cannonball and cannon is conserved.
    2. Momentum of the cannonball and cannon is conserved.
    3. Energy of the cannon is greater than the energy of the cannonball.
    4. Momentum of the cannon is greater than the energy of cannonball.
18. The acceleration of gravity on the Moon is one-sixth of that on Earth. If you hit a baseball on the Moon with the same effort (and at the speed and angle) that you would on Earth, the ball would land:
    1. the same distance away.
    2. one-sixth as far.
    3. 6 times as far.
    4. 36 times as far.
19. A child falls sideways off a sled while sledding on frictionless ice. What happens to the velocity of the sled?
    1. It increases.
    2. It remains the same.
    3. It decreases.
    4. Cannot be determined.
20. Momentum is conserved. Therefore…
    1. It is impossible to change the amount of momentum within a system.
    2. The amount of momentum within a system can only be changed if the objects within the system apply a force to one another.
    3. The amount of momentum within the system is zero.
    4. The amount of momentum can only be changed if the objects within the system experiences a non-zero net force from outside the system.
21. Which of the following is an accurate statement?
    1. The momentum of a projectile is constant.
    2. The momentum of a moving object is constant.
    3. If an object is acted on by a non-zero net external force, its momentum will not remain constant.
    4. If the kinetic energy of an object is doubled then its momentum is doubled.
22. Two equal mass balls (one red and the other blue) are dropped from the same height, and rebound off the floor. The red ball rebounds to a higher position. Which ball is subjected to the greater magnitude of impulse during its collision with the floor?
    1. It’s impossible to tell since the time intervals and forces are unknown.
    2. Both balls were subject to the same magnitude impulse.
    3. The blue ball
    4. The red ball
23. Ignoring air resistance, the horizontal component of a projectile’s velocity:
    1. is zero.
    2. remains constant.
    3. continuously increases.
    4. continuously decreases.
24. An object floats in water with ¾ of its volume submerged. What will happen if it is placed in an oil with a density half that of water?
    1. It floats just as before.
    2. It floats higher than in the water.
    3. It floats lower than in the water.
    4. It sinks.
25. You are standing in a moving bus, facing forward, and you suddenly fall forward. You can imply from this that the bus’s:
    1. Velocity decreased
    2. Velocity increased
    3. Speed remained the same, but it’s turning right
    4. Speed remained the same, but it’s turning left.
26. If one material has a higher density than another, does this mean that the molecules of the first material must be more massive than those of the second?
    1. Yes
    2. No
    3. Not enough information to tell.
    4. It is dependent upon the material’s temperature.
27. Can an object’s velocity change direction when its acceleration is constant?
    1. No, this is not possible because it is always speeding up.
    2. No, this is not possible because it is always speeding up or slowing down.
    3. Yes, this is possible, and a rock thrown straight up is an example.
    4. Yes, this is possible, and a car that starts from rest, speeds up, slows to a stop, and then backs up in an example.
28. A child’s toy is suspended from the ceiling by means of a string. The Earth pulls downwards on the toy with its weight force of 8.0 N. If this is the “action-force,” what is the “reaction-force”?
    1. The string pulling upward on the toy with an 8.0-N force.
    2. The ceiling pulling upward on the string with an 8.0-N force.
    3. The string pulling downward on the ceiling with an 8.0-N force.
    4. The toy pulling upward on Earth with an 8.0-N force.
29. An aluminum cylinder and pail together weigh 29 N, as read on a scale. With the cylinder submerged, the scale reads 20 N. If the displaced water is poured into the pail, what will the scale read?
    1. Less than 20 N
    2. 20 N
    3. Between 20 N and 29 N
    4. 29 N
    5. Greater than 29 N
30. A soccer ball is kicked with a velocity of 25 m/s at an angle of 45-degrees above the horizontal. What is the vertical component of its acceleration as it travels along its trajectory?
    1. 9.80 m/s2 downward
    2. (9.8 m/s2)×sin(45) downward
    3. (9.8 m/s2)×sin(45) upward
    4. 9.80 m/s2 upward

Part II: Problem Set

Each correctly answered question is worth **3 points**.

Be sure to record your answer, with correct significant figures and units on the answer sheet to receive credit for your response.

Problems 40, 34, & 38 will be used (in that order) as tie breakers.

31. A slingshot launches a rock off the edge of a 15.0 m cliff at a 50.0° angle and with an initial velocity of 30.0 m/s. How far from the edge of the cliff does the rock land?

32. A pair of figure skaters (m1 = 65.0 kg m2 = 45.0 kg) are initially at rest next to each other on the ice. To start a trick the first skater throws the second west with a force of 120 N. How far apart will the skaters be 2.30 seconds later?

33. A 2000. kg car traveling north at 3.00 m/s hits a patch of black ice and collides with the guardrail. If during the 0.25 seconds the guardrail and car were in contact the car experiences a force of 25000. N west, what will its velocity be after the collision?

34. If a quarterback is capable of throwing a football 75 meters in 3.00 seconds, what was the ball’s initial velocity? (ignore the height of the football player).

35. A 100.0 kg roller coaster cart is traveling at 50.0 m/s when it reaches the bottom of its first hill and then continues over a second hill that is 100.0 m tall. How quickly is the roller coaster moving as it crests the second hill?

36. While skateboarding east at an initial velocity of 3.00 m/s you notice an object in the path 2.50 m ahead. If you accelerate at a rate of 1.5 m/s2 west will you stop in time?

37. During the filming of an action movie, a stuntman must ride his motorcycle off a 15 m cliff. At what speed should he be traveling when he reaches the edge of the cliff to safely land on the mat located 50 m from the base of the cliff?

38. What is the force required to hold a basketball with a mass of 624 g and diameter of 24.3 cm fully under water?

39. The small and large pistons of a hydraulic press have areas of 2.00 cm2 and 4.00 cm2. If the load on the large piston is 3200 N, what is the input force that must be applied on the small piston?

40. Through a refinery, fuel ethanol is flowing in a pipe at a velocity of 1 m/s and a pressure of 101300 Pa. The refinery needs the ethanol to be at a pressure of 2 atm (202600 Pa) on a lower level. How far must the pipe drop in height in order to achieve this pressure? Assume the velocity does not change. (The density of ethanol is 789 kg/m3 and gravity g is 9.8 m/s2)