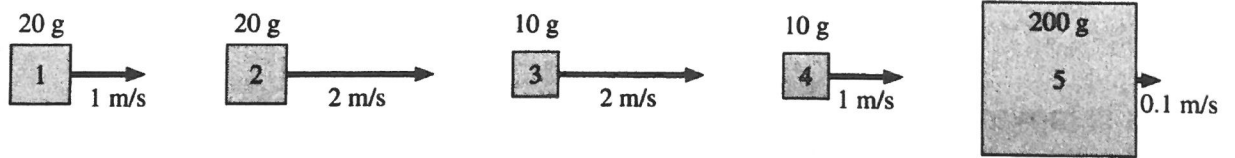


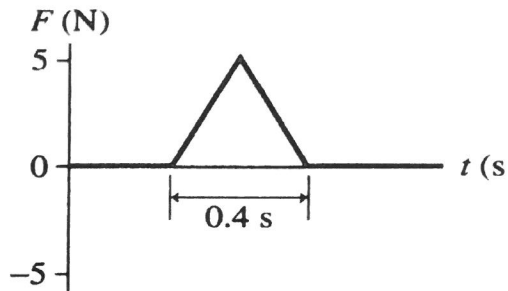
Division B Hovercraft Regional Test 2018

1) Rank in order, from smallest to largest, the momenta  $P_1$  to  $P_5$ :



- a. 1, 2, 3, 4, 5
- b. 2, 1, 3, 5, 4
- c. 3, 4, 1, 2, 5
- d. 4, 1, 3, 5, 2

2) What impulse is delivered by this force  $F(N)$ ?



- a. 1 Ns
- b. 0.4 Ns
- c. 2 Ns
- d. 5.4 Ns

3) A rotor on a helicopter spins at 462 rpms. What is the frequency in revolutions per second?

4) A block of mass 3 kg is pushed along a table with a velocity  $v$  and slides a distance of 16 m after the force that pushes it is removed. If another block with a mass of 6 kg that is otherwise identical is pushed along the same table with velocity  $v$ , what distance will it slide after the pushing force is removed?

- 5) Suppose you are riding on a hovercraft that can move straight up and down. For each of the following situations, choose which option is true.

Option X) Apparent Weight is equal to True Weight;

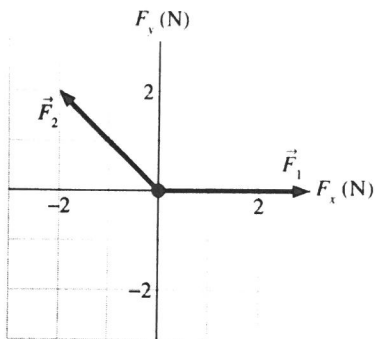
Option Y) Apparent Weight < True Weight;

Option Z) Apparent Weight > True Weight

Situation:

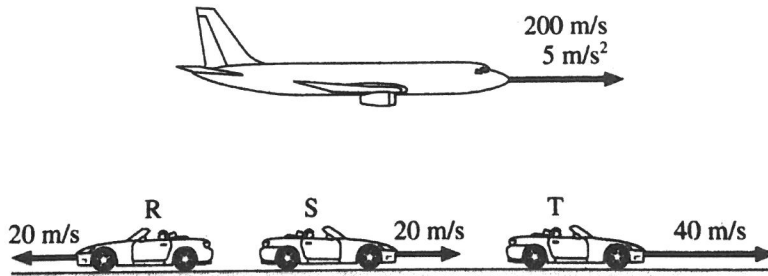
- 5a) You are ascending at a constant speed.  
5b) You are descending at a constant speed.  
5c) You are ascending and speeding up.  
5d) You are descending and speeding up.

- 6) The forces shown with vectors below are acting on an object. What is the total force acting on the object?

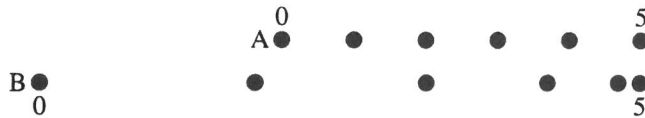


- a.  $2\hat{j}$   
b.  $-\hat{i}$   
c.  $2\hat{i} - \hat{j}$   
d.  $\hat{i} + 2\hat{j}$   
e.  $-\hat{j}$   
f.  $\hat{i} + \hat{j}$   
g.  $2\hat{i} - 2\hat{j}$
- 7) A decorative fountain sprays water from a nozzle at ground level. Which of these angles between the nozzle and the ground will result in the water travelling the farthest before it lands?
- a.  $35^\circ$   
b.  $42^\circ$   
c.  $49^\circ$   
d.  $55^\circ$   
e.  $76^\circ$

- 8) Drivers in cars R, S, and T all see the jet at the same instant. From the perspective of the driver in car R the jet is moving \_\_\_\_\_ than it is from the perspective of the driver in car S.

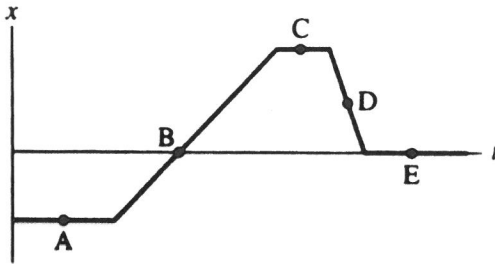


- $20 \text{ m/s}$  slower
  - $20 \text{ m/s}$  faster
  - $40 \text{ m/s}$  slower
  - $40 \text{ m/s}$  faster
- 9) A strobe flashes every second for five seconds and captures the locations of two balls which are both moving from left to right. At which time(s) will the balls be one directly above the other? Write all that apply.



- 0 seconds
- 1 second
- 2 seconds
- 3 seconds
- 4 seconds
- 5 seconds
- Never

10) The figure shows a position versus time graph.



10a) At which labelled point(s) is the object moving the fastest?

10b) At which labelled point(s) is the object not moving?

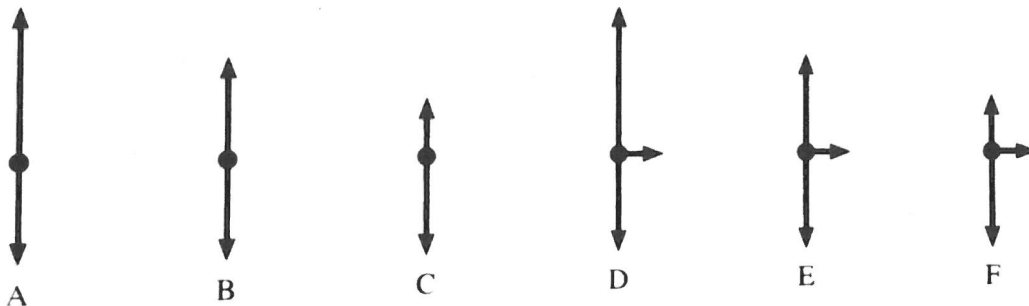
11) A drone starts from rest and accelerates at  $3 \text{ m/s}^2$  for two seconds, then travels at a constant rate for 10 seconds before crashing into a wall. How far did it travel?

- a. 36 m
- b. 60 m
- c. 66 m
- d. 72 m

12) A steady force is applied to a 4 kg block and as a result the block accelerates at  $2 \text{ m/s}^2$ . This same force is then applied to another block of unknown mass, causing it to accelerate at  $4 \text{ m/s}^2$ . What is the mass of the second block?

13) Three forces  $F_1 = (-2, -3)$ ,  $F_2 = (.75, -4)$  and  $F_3 = (-1, 6)$  are acting on an object. What force  $F_4$  will cause the object to be at equilibrium?

14) A ball rolls freely from left to right over the top of a curved track without friction. At the very top of the highest point on the track what is the ball's free-body diagram?



- 15) If a car's speed changes by a factor of four, by what factor does its kinetic energy change?
- 16) A girl riding in a sled wants to throw a snowball to hit her brother as she passes where he is standing. If she lets go of the snowball exactly when he is directly to her left should she throw the snowball...
- a. Left and backward
  - b. Exactly to the left
  - c. Left and forward
- 17) A driver in a 540 kg car is going 100 kph when she sees a traffic jam ahead and hits the brakes, stopping suddenly. Which of the following statements is true?
- a. The kinetic energy that the car had before braking was converted to potential energy.
  - b. The kinetic energy that the car had before braking was converted to thermal energy.
  - c. The kinetic energy that the car had before braking was transferred to the road.
  - d. The kinetic energy that the car had before braking ceased to exist.
  - e. None of the above are true.

## Division B Hovercraft Answer Key

This test is worth 21 points. All questions are worth one point.

1. A B C **D**

2. **A** B C D

3. 7.7 rps

4. 16 m

5. (1 pt each)

a. X

b. X

c. Z

d. Y

6. A B C **D** E F G

7. A **B** C D E

8. A B C **D**

9. A B **C** D E **F** G

10. (1 pt each)

a. A B C **D** E

b. **A** B **C** D **E**

11. A B **C** D

12. 2 kg

13. (2.25, 1)

14. A **B** C D E F

15. 16

16. **A** B C

17. A **B** C D E