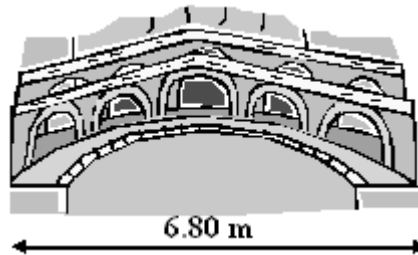


## 2APHY: Motion and Force: Unit Test. QUESTIONS

Name: \_\_\_\_\_ **QUESTIONS** \_\_\_\_\_ (40 marks)

1. Stephenie is in Venice on a round the world tour. She travels across an old arched bridge to get to her favourite café. The arch bridge has a walkway with an arched length of 7.50 m but a bridge span of only 6.80 m.



If it takes Stephanie 4.50 s to cross the bridge, calculate:

- a. Stephanie's speed. (2 marks) | b. Stephanie's velocity. (2 marks)

2. Victoria works in Coles doing night fill. She has to lift three 1.50 kg boxes of laundry detergent from the floor to the shelf 1.10 m above the floor. If it took 1.50 seconds to lift all boxes at once to the shelf, what power was required? (2 marks)

3. A hot-air balloon, total mass  $9.00 \times 10^1$  kg has a horizontal ground velocity of  $105 \text{ km h}^{-1}$ . As it increases its altitude to  $2.00 \times 10^3$  m, its gravitational potential energy is increased by 17.64 MJ. How much work was done? (Note: M is mega which is  $1 \times 10^6$ ) (2 mark)

4. Michael is a world champion runner and can reach a maximum velocity of at least  $10.1 \text{ ms}^{-1}$ . If Michael's mass is  $58.0 \text{ kg}$ , determine his kinetic energy. (2 marks)

5. Casey is walking to the shops. He is walking along at a fast but comfortable velocity. He then starts to climb a hill and finds that to maintain the same velocity is much harder. Using your understanding of physics, explain why it is harder to walk up a hill than to walk on a flat path.

(2 marks)

6. Simon and Shaun are at the Royal Show on the bumper cars. The two boys have the same mass as do the bumper cars so the total mass of each is car and rider is  $170 \text{ kg}$ . Simon is heading east towards Shaun at  $3.50 \text{ ms}^{-1}$  and hits Shaun's car head on. Simon's car rebounds at  $1.90 \text{ ms}^{-1}$  and Shaun's car rebounds at  $2.50 \text{ ms}^{-1}$ . What was the initial velocity of Shaun's car?

(2 marks)



7. Jasmine, who has a mass of 60.0 kg, is a triathlete in training for the bicycle component of the event. She is riding her bicycle (28.0 kg) at a constant velocity of  $50.4 \text{ kmh}^{-1}$  on a flat surface. The combined frictional forces are 45.0 N. She maintains her velocity for 12.0 s.
- What force does Jasmine need to overcome in order to move with a constant velocity? (2 mark)
  - Calculate the work done by Jasmine. (2 marks)
  - What is Jasmines's power output? (2 marks)
  - On the diagram of Matthew, show the forces acting on him and label them appropriately. (2 marks)



8. William, a non-physics student, is asked by his mum to help push a car trailer out of the way. William tells his mum that there is no point as Newton's Third Law states that every force produces an equal and opposite force so if he pushes the car trailer, the car pushes back so nothing moves. Explain Newton's Third Law to William and why he is able to push the car trailer out of the way. (3 marks)
9. Simon is off to Mars for his holidays. (Mars has an acceleration due to gravity of  $3.4 \text{ ms}^{-2}$ ). His suitcase has a mass of 25 kg on Earth. Simon notices that his suitcase is always much easier to carry on Mars.
- Calculate the mass and weight of Simon's suitcase on Mars. (2 marks)
  - Why do you think that Simon's suitcase is easier to carry on Mars? (1 marks)
10. Which pedal of the car is being used when
- the net force acting on the car is in the opposite direction as the car's velocity
  - the net force and velocity are in the same direction?
11. A sand blaster is used to strip paint from a house. The sand blaster throws the sand against the wall with a velocity of  $50.0 \text{ ms}^{-1}$ , and it rebounds in the opposite direction at an average velocity of  $8.00 \text{ ms}^{-1}$ . Find the average force on the house if 0.2 kg hits it each second. (2 marks)

12. a. Ryan is on a sightseeing tour in a helicopter. When the helicopter is travelling downwards at  $18 \text{ kmh}^{-1}$ , Ryan looks out of the window and his 100 g sunglasses fall off. If the glasses were 140 m above the ground when they fell off, with what velocity will the sunglasses hit the ground? (2 marks)

- b. The glasses landed in soft sand. If it took 0.006 s to stop, what force was applied to the sunglasses? (2 marks)

**Note: The wrong time was in the question you had and should have been as above.**

- c. Calculate the glasses acceleration between hitting the ground and stopping. (2 marks)

- d. Calculate the displacement of the glasses between hitting the ground and stopping. (2 mark)

**BONUS QUESTION: Not to be attempted unless the test is finished.**

Dangerous Dan is travelling along the road at a constant  $90 \text{ kmh}^{-1}$  (unfortunately for Dan the speed limit is  $60 \text{ kmh}^{-1}$ ). Dan's car passes policeman Bob who on his stationary police bike just as Bob starts to accelerate his bike at  $6.8 \text{ ms}^{-2}$  to catch Dan and book him. How far will the car travel before the police bike reaches it? (3 marks)