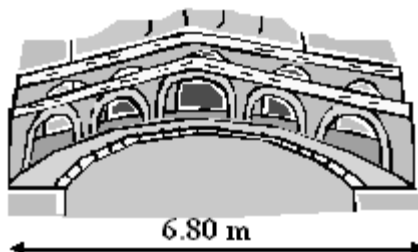# YEAR 11 PHYSICS 2AB

Motion and Force End Of Unit Test

TOTAL = 55 Marks

Name: _____

1. Stephanie 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. Samantha 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 9.00×10^1 kg has a horizontal ground velocity of 105 kmh^{-1}. As it increases its altitude to 2.00×10^3 m, its gravitational potential energy is increased by 17.64 MJ. How much work was done? (Note: M is mega which is 1.00×10^6)   (2 marks)

4. Gabriel is a world champion runner and can reach a maximum velocity of at least 10.1 ms⁻¹. If Gabriel's mass is 58.0 kg, determine his kinetic energy. (2 marks)

5. Claudia is walking to the shops. She is walking along at a fast but comfortable velocity. She 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. Semjon and Cavan are at the Royal Show on the bumper cars. The two students have the same mass as do the bumper cars so the total mass of each is car and rider is 170 kg. Semjon is heading east towards Cavan at 3.50 ms⁻¹ and hits Cavan's car head on. Semjon's car rebounds at 1.90 ms⁻¹ and Cavan's car rebounds at 2.50 ms⁻¹. What was the initial velocity of Cavan's car? (3 marks)

7. Esther, who has a mass of 60.0 kg, is a triathlete in training for the bicycle component of the event. Esther is riding her bicycle (28.0 kg) at a constant velocity of 50.4 kmh⁻¹ on a flat surface. The combined frictional forces are 45.0 N. She maintains her velocity for 12.0 s.

   (a) What force does Esther need to overcome in order to move with a constant velocity? (2 marks)

(b) Calculate the work done by Esther. (4 marks)

(c) What is Esther's power output? (2 marks)

(d) On the diagram of Esther on her bicycle below, show the forces acting on her and label them appropriately. (2 marks)

8. Jesse, a non-physics student, is asked by his mum to help push a car trailer out of the way. Jesse 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 Jesse and why he is able to push the car trailer out of the way. (3 marks)

9. Lachlan is off to Mars for his holidays. (Mars has an acceleration due to gravity of 3.40 ms^{-2}). Lachlan's suitcase has a mass of 25.0 kg on Earth. Lachlan notices that his suitcase is always much easier to carry on Mars.

(a) Calculate the mass and weight of Simon's suitcase on Mars. (3 marks)

(b) Why do you think that Lachlan's suitcase is easier to carry on Mars? (1 mark)

10. Joshua is driving his super hot red Ferrari down the road. Which pedal of the car does Joshua use when:

(a) the net force acting on the car is in the opposite direction to the car's velocity? (1 mark)

(b) the net force and velocity are in the same direction? (1 mark)

11. A sand blaster is used to strip paint from Evan's house. The sand blaster throws the sand against the wall with a velocity of 50.0 ms^{-1}, and it rebounds in the opposite direction at an average velocity of 8.00 ms^{-1}. Find the average force on the house if 0.2 kg of sand hits it each second. (2 marks)

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12. Robert is on a sightseeing tour in a helicopter. When the helicopter is travelling downwards at 18.0 kmh^{-1}, Robert looks out of the window and his 100 g sunglasses fall off.

(a) If the glasses were 140 m above the ground when they fell off, with what velocity will the sunglasses hit the ground? (3 marks)

(b) The glasses landed in soft sand. If it took 0.006 s to stop from the instant the glasses hit the sand, what force was applied to the sunglasses? (3 marks)

(c). Calculate the sunglasses' acceleration between hitting the ground and stopping in the sand. (2 marks)

(d)   Calculate the displacement of the sunglasses between hitting the ground and stopping in the sand. (2 marks)

13.   A 25.0 g light fitting falls off the top of the stage of the Ellen Street Theatre. If the stage was 30.0 m from the floor, find:

(a)   The initial potential energy of the light fitting (2 marks)

(b)   The velocity of the light fitting the instant before it smashed into the stage floor. (2 marks)

(c)   The kinetic energy of the light fitting the instant before it smashed into the stage. (1 mark)

(d)   Was this an elastic collision? Explain your answer. (2 marks)

14.   Rishma runs 100 m in 10.0 s and then walks another 100 m in 30 s. In which case does Rishma do more work? Explain your answer (2 marks)

END OF TEST