Saigon
International
College

AEPHY

Test #5

Forces And Energy

Task Weighting: 4% of the school mark for this pair of units

Time: Reading: 5 minutes

Writing: 70 minutes

Student Name: _Chu Minh Đăng_

Score: /53

Time: 75 minutes   Total questions: 10

Show all you working for FULL marks. Where necessary use the constants and values supplied on the School Curriculum and Standards Authority Formula and Data sheet provided. Final answers in 3 s.f.

Question 1 (10marks)

A crane lifts a 1100 kg car vertically at a constant velocity. If the car is raised a total height of 4.0 m, determine:

a) a free-body diagram of forces acting on the car and label the forces.   [2]

b) the magnitude of the force needed to lift the car.   [2]

c) the work done by the lifting force.   [2]

d) the new lifting force if the car is accelerated upwards at 2 ms^{-2}.   [4]

Question 2 (3marks)

Superman pushes against a wall with 15 000 N of force, but the wall does not move.

a) Is the wall exerting a force? If it is, how much?   [1]

b) Which of Newton's Law of Motion does this situation obey? State which law and define it.

[2]

Question 3 (5marks)

a) Identify the situation where motion is accelerated only by the force of gravity.   [1]

....

b) Identify the situation where constant velocity is achieved in the type in part a)   [1]

...

c) Identify the force that opposes gravity in part b.   [1]

....

d) What factors increase the force that opposes the gravity force?   [2]

....

Question 4 (4marks)

A stationary car of mass 1150 kg is hit from behind by a car of mass 1800 kg traveling north at a constant velocity of 15.0 ms^{-1}. The stationary car is pushed northward at a speed of 11.5 ms^{-1}. Show your working. Calculate the velocity of the 1800 kg car after the collision and its direction.

Question 5 (5marks)

A passenger in a car strikes his head against the **unpadded** dashboard with an average force of 56.0 N for 2.70 x 10^{-3}seconds during an accident. If a layer of **foam padding** was used in the dashboard, the impact would have lasted for 5.80 x 10^{-3}seconds. If impulse stays the same:
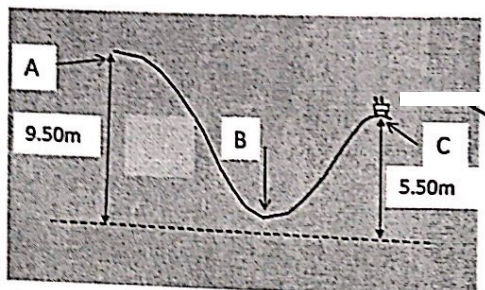
a) Calculate the average reaction force the padded dashboard would exert.   [3]

b) Using your knowledge of physics principles, explain why cars are designed to crumple when they hit something?   [2]

Question 6 (9marks)

A roller coaster trolley has a mass of 280 kg. At point C, the speed of the roller coaster trolley was measured as 10.0 ms^{-1}.

a) At which point along the track will the roller coaster have the greatest speed?   [1]

b) Calculate the total energy of the trolley at point C. Show your working.   [3]

c) While the trolley was traveling from point A to Point C, it experienced a frictional force which caused it to lose 20% of its total energy. In other words, the energy at point C is only a percentage of the total at point A. Calculate the roller-coaster car's initial speed at point A. Show your working.

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Question 7 (4marks)

A 0.250 kg ball bounces on a hard surface after being dropped from a height. The ball retains 80% of its kinetic energy in the collision and rises to a maximum height of 0.870 m above the ground. Calculate its potential energy at A.
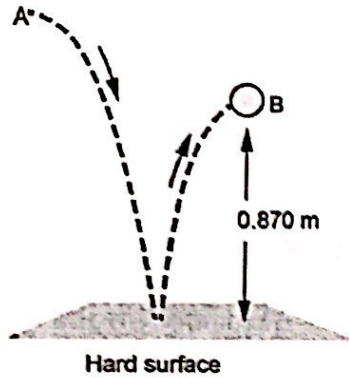
Question 8 (5marks)

A bolt with a mass of 2.5 x10^{-1} kg falls from a height to the ground. The ground consists of soft soil and the bolt enters the soil and stops 2.25 × 10^{-2} m below the surface. If the velocity was 25.0 m s^{-1} just before hitting the ground, calculate the magnitude of the force that the ground has exerted on the bolt.

Question 9 (5marks)

A 0.45 kg ball traveling at 20.0 ms^{-1} [south] hits a wall and bounces off at a velocity of 16.0 ms^{-1} [north]. The ball is in contact with the wall for 2.5 x 10^{-2} s. Include direction for full marks.

a) Calculate the initial momentum of the ball. [2]

b) Calculate the change in momentum of the ball. [3]

Question 10 (3marks)

A box with a mass of 22.0 kg is placed on a ramp that is at an angle of 38.0 degrees above the horizontal. What is the magnitude of the net force?