



Total Marks = [50]

Time: 50 mins

NAME: _____**Question 1****(2 marks)**

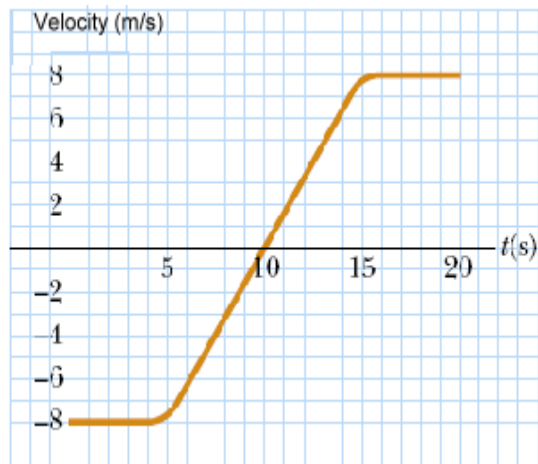
A farmer walked 745 m West from a gate to repair a fence post. When that job was finished he turned around and walked 984 m East to repair another part of the fence. Draw and label a vector diagram of his total journey then calculate his resultant displacement.

Question 2**(2 marks)**

If the total time spent walking by the farmer was 30 minutes, calculate his average velocity and his average speed?

Question 3**(6 marks)**

The velocity–time graph for a remote control car is shown below.



(a) What is the velocity and acceleration of the car at $t = 10$ s?

[2 marks]

(b) In the space to the right of the graph plot a graph of the acceleration of the car against time.

[2 marks]

(c) Determine the displacement of the car in the time from $t = 5$ s to $t = 20$ s.

[2 marks]

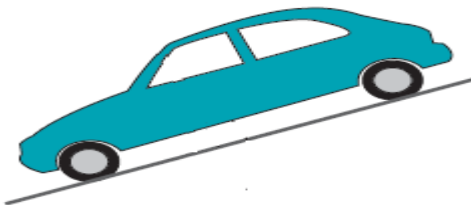
Question 4**(4 marks)**

A runway at a small airport is 1220 m long. A light aircraft accelerates at 0.785 m s^{-2} along this runway, starting at one end and taking off 200 m before reaching the other end. If the aircraft was initially stationary, calculate its speed when it took off.

Question 5**(12 marks)**

A car of mass 1600 kg left parked on a steep but rough road begins to roll down the hill. After a short while it reaches a constant speed. The road is inclined at 15° to the horizontal. Its speed is sufficiently slow that the air resistance is insignificant and can be ignored.

- a. Draw in the forces acting on the car when it is parked.

[3 marks]

- b. Determine the component of the car's weight that acts parallel to the road **AND** the component that acts perpendicular to the road. **[2 marks]**

- c. Is there a net force acting on the car when it is parked? Explain.

[1 mark]

c. Is there a net force acting on the car when it is rolling down the hill at constant velocity? Explain.
[2 marks]

d. What is the value of the normal reaction force that the road exerts on the car **AND** the value of road friction when it is rolling down the hill at constant velocity?
[2 marks]

e. As the car comes out of the hill onto the flat road at the base of the hill, what happens to the value of the normal reaction force? Explain.
[2 marks]

Question 6**[8 marks]**

Two physics students, James and Jordan, conduct the following experiment from a very high bridge. James drops a 1.5 kg shot-put from a vertical height of 60.0 m while at exactly the same time Jordan throws a 100 g mass with an initial downwards velocity of 10.0 m s^{-1} from a point 10.0 m above James.

Calculate the time that:

- a. the shot-put takes to reach the ground

[2 marks]

- b. the 100 g mass takes to reach the ground.

[2 marks]

- c. At what time will the 100 g mass overtake the shot-put?

[2 marks]

- d. Explain why the acceleration of the shot put and the 100 g mass are the same, even though the shot put is heavier.

[2 marks]

Question 7**[6 marks]**

Free-body diagrams are diagrams used to show the relative magnitude and direction of all forces acting upon an object in a given situation. Draw a free body diagram for each of the situations shown below:

a. An egg is free-falling from a nest in a tree. Neglect air resistance. **[2 marks]**

b. A book is at rest on a tabletop. **[2 marks]**

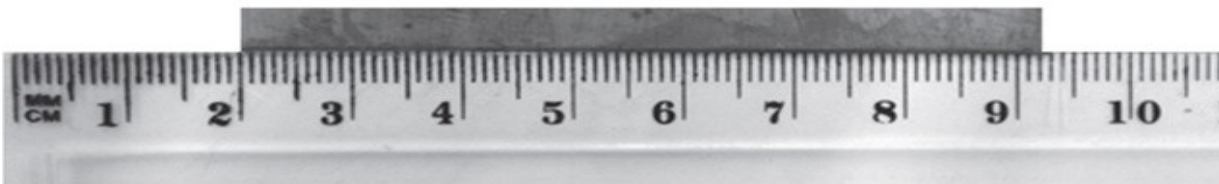
c. As a result of a flat battery, Mr Reberger's car is towing Mr Robinson's with a tow rope at a constant velocity. Draw a free body diagram of the forces acting on Mr Robinson's car **[2 marks]**

Question 8**[4 marks]**

The photographs below show a thermometer used to measure the temperature of a solution, and a ruler measuring the length of a metal strip. For each photograph, record the measurement and state the uncertainty of the measurement.



- a. The temperature measured by the thermometer is _____ °C.
b. The uncertainty is _____ °C.



- c. The length of the metal strip measured by the ruler is _____ cm.
d. The uncertainty is _____ cm.

Question 9**[6 marks]**

A 70 kg fisherman is quietly fishing in a 40 kg dinghy at rest on a still lake when, suddenly, he is attacked by a swarm of wasps. To escape, he leaps from the boat into the water with a force of 140 N.

a. What is the force acting on the boat?

[1 mark]

b. With what acceleration will the boat move?

[2 marks]

c. If the force on the fisherman lasted for 0.5 s, determine the speed attained by both the man and boat.

[3 marks]