Year 11 Test Review Motion 2

Questions

Q1

A plane of mass 750 kg is at rest on a runway. The engine applies a force of 4·50 kN.

(*a*) Calculate the magnitude of the acceleration of the plane assuming there are no other forces acting on the plane at this point.

(*b*) The required speed for take-off is 54 m/s.

Calculate the time it takes to reach this speed assuming the acceleration is constant.

Q2

In a garage, a mechanic lifts an engine from a car using a pulley system.

(*a*) The mechanic pulls 4·5 m of chain with a constant force of 250 N.

Calculate the work done by the mechanic.

(*b*) The engine has a mass of 144 kg and is raised 0·75 m.

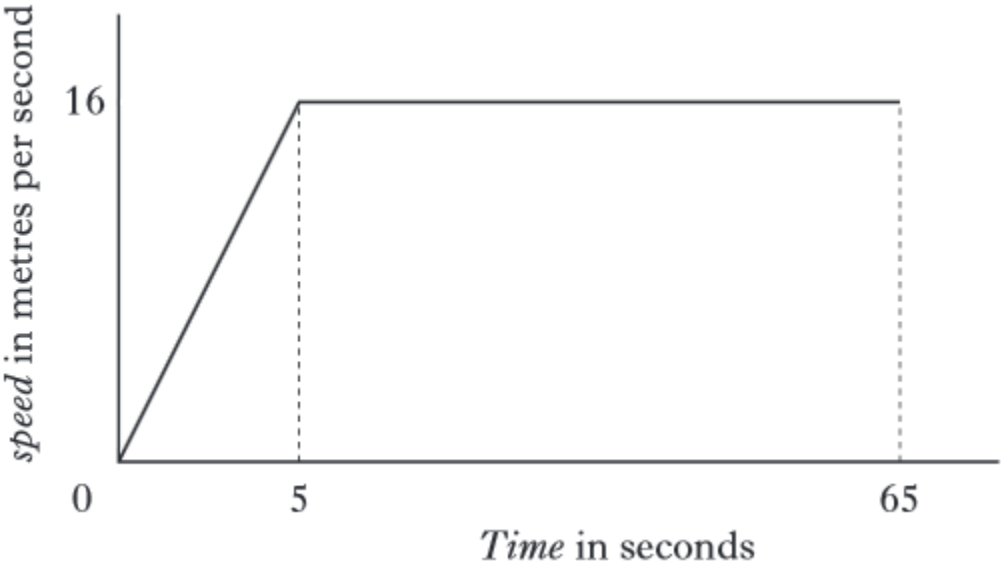
Calculate the gravitational potential energy gained by the engine.

Q2 continued

(*c*) Calculate the percentage efficiency of the pulley system.

Q3

The graph below shows the speed of a cyclist during a 1000 metre sprint race.



(*a*) State the maximum speed of the cyclist during the race.

Q3 continued

(*b*) Calculate the average speed of the cyclist during the race.

Q4

An unmanned spacecraft is on a mission to Mars.

The engines of the spacecraft are turned off once it has travelled far into space.

(a) The spacecraft now travels at a constant speed.

Explain why this happens.

Q4 continued

The table below gives some information on the planets.

Planet	*Gravitational pull in* newtons per kilogram
Earth	10
Mars	4
Jupiter	26
Saturn	11

(b) The spacecraft has a mass of 900 kg.

(i) What is the weight of the spacecraft on Earth?

Q4 continued

(ii) Complete the following sentence by **circling** the correct word or phrase.

The mass of the spacecraft on Mars is

- the same as its mass on Earth.
- zero.
- different from its mass on Earth.

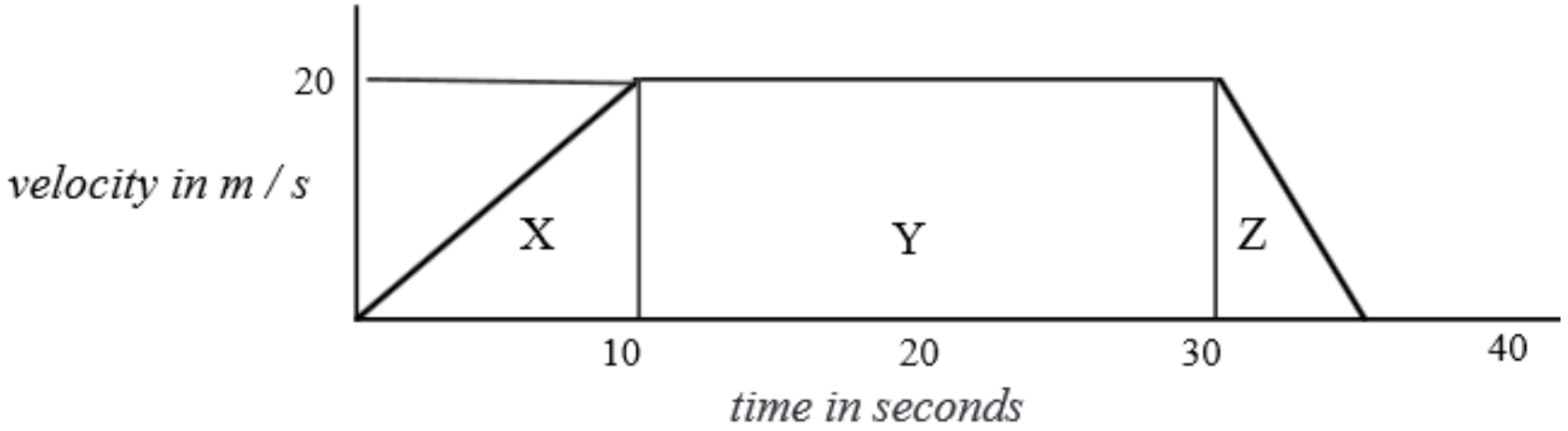
Q5

The graph describes the motion of a car during 35 seconds.

a) What was the initial acceleration of the car?

b) What was the deceleration?

c) How far did the car travel in the 35 seconds?



Q6

a) What is the weight of a 50 kg girl on Earth?

b) What would she weigh on the moon where the gravitational field strength is 1.6 N/kg?

Q7

A car of mass 1000 kg has an unbalnced force of 1600 N acting on it. What will be its acceleration?

Q8

A car of mass 1000 kg experiences friction equal to 500 N. If the engine force is 1300 N, what will be the car's acceleration?

Q9

A car of mass 1000 kg travelling at 20 m/s collides with a stationary van of mass 1200 kg. If the van moves off at 5 m/s, what will be the velocity of the car after the collision?

Q10

A dog pulls a 4 kg sledge for a distance of 15 m using a force of 30 N. How much work does the dog do?

Q11

A cyclist uses a force of 60 N and travels 2 km in 8 minutes.

What is her average power?

Q12

A chairlift raises a skier of mass 50 kg to a height of 250 m. How much potential energy does the skier gain?

Q13

How much kinetic energy does a car of mass 1000 kg

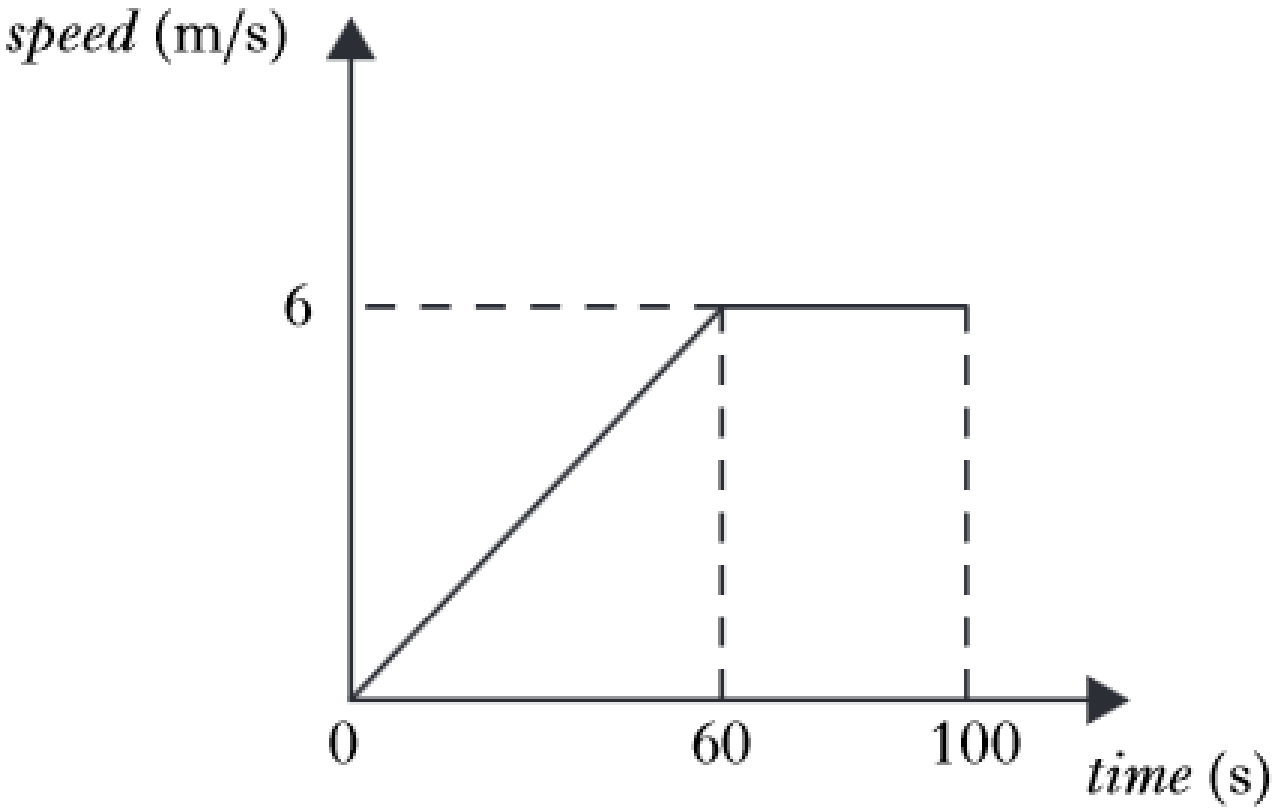
have when it is travelling at 20 m/s

Q14

What is the efficiency of an electric hoist which uses a 400 W motor if it takes 10 s to lift a 60 kg load to a height of 4 m?

Q15

- A balloon of mass 400 kg rises vertically from the ground. The graph shows how the vertical speed of the balloon changes during the first 100 s of its upward flight.



Q15 continued

(*a*) Calculate the acceleration of the balloon during the first 60 s.

Q15 continued

(*b*) Calculate the distance travelled by the balloon in 100 s.

(*c*) Calculate the average speed of the balloon during the first 100 s.

Q15 continued

(*d*) Calculate the weight of the balloon.

(*e*) Calculate the total upward force acting on the balloon during the first 60 s of its flight.

Q16

A ski lift with a gondola of mass 2000 kg travels to a height of 540 m from the base station to a station at the top of the mountain.

(*a*) Calculate the gain in gravitational potential energy of the gondola.

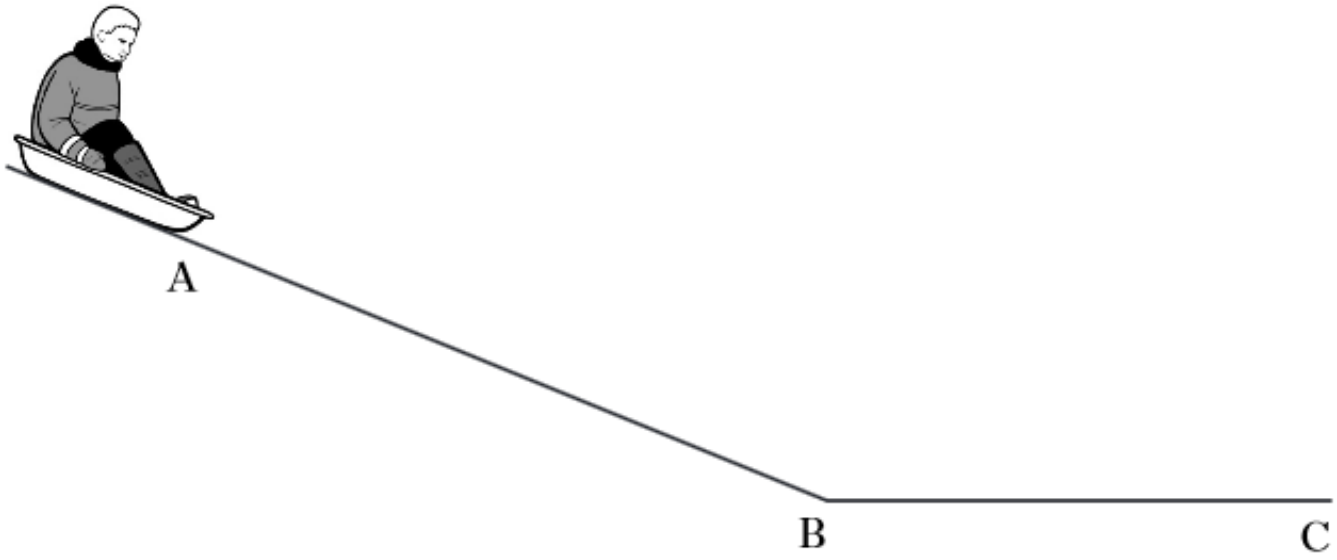
Q16 continued

(*b*) During the journey, the kinetic energy of the gondola is 64 000 J.

Calculate the speed of the gondola.

Q17

A child sledges down a hill.



The sledge and child are released from rest at point A. They reach a speed of 3 m/s at point B.

(*a*) The sledge and child take 5 s to reach point B.

Calculate the acceleration.

Q17 continued

(*b*) The sledge and child have a combined mass of 40 kg.

Calculate the unbalanced force acting on them.

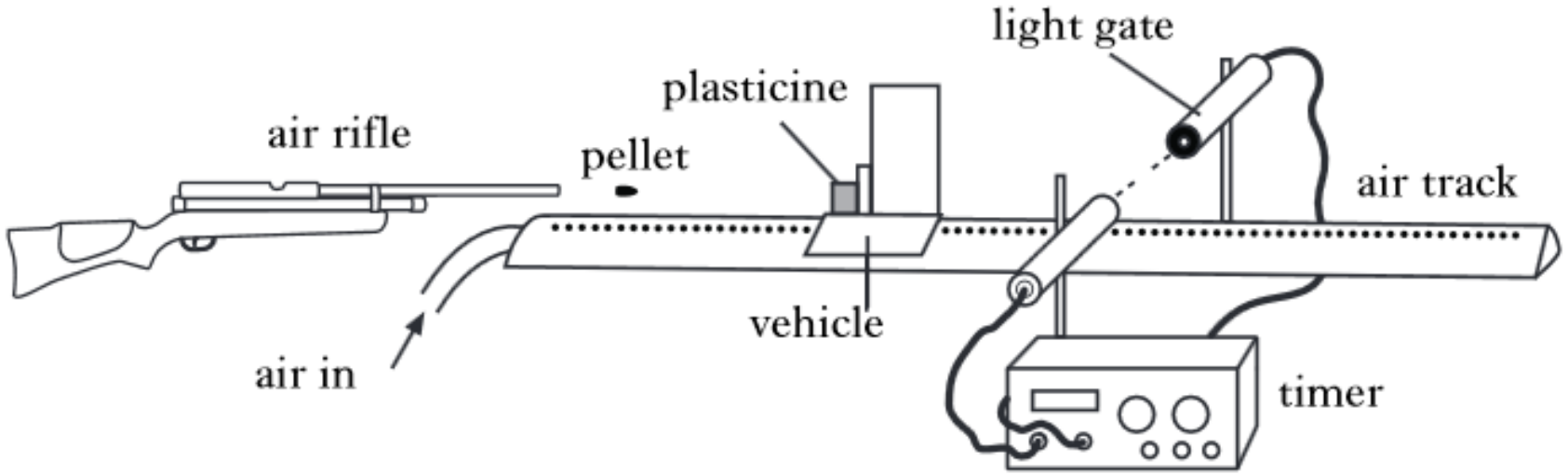
Q18

(*c*) After the sledge and child pass point B, they slow down, coming to a halt at point C.

Explain this motion in terms of forces.

Q19

The following apparatus is used to determine the speed of a pellet as it leaves an air rifle. The air rifle fires a pellet into the plasticine, causing the vehicle to move.



Q19 continued

The speed of the vehicle is calculated as 0·35 m/s after impact.

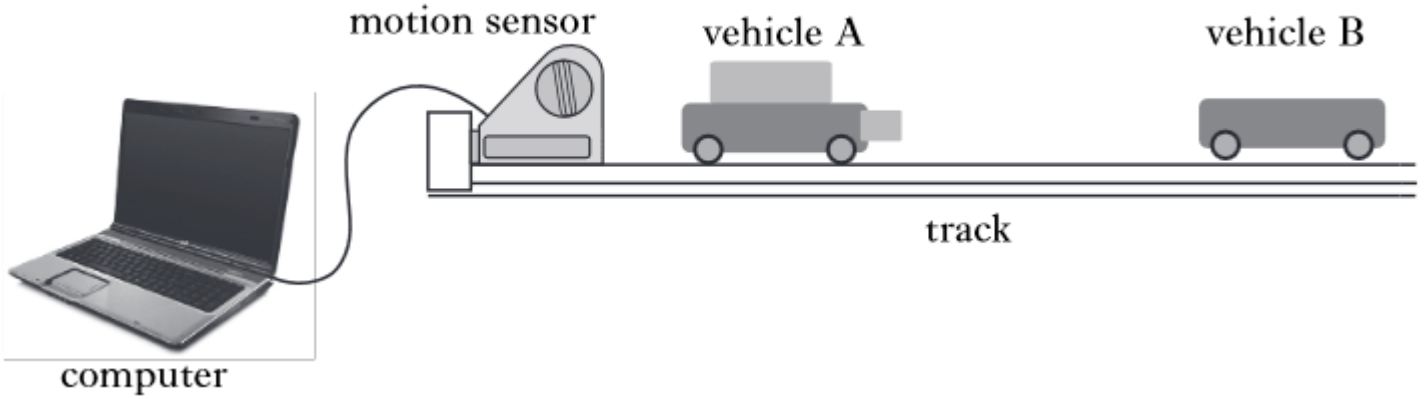
The mass of the pellet is $5{\cdot}0 \times 10^{-4}$ kg. The mass of the vehicle and plasticine before impact is 0·30 kg.

(i) Show that the momentum of the pellet **before** impact with the plasticine is 0·105 kg m/s.

(ii) Hence, calculate the velocity of the pellet **before** impact with the plasticine.

Q20

The apparatus shown is set up to investigate collisions between two vehicles on a track.

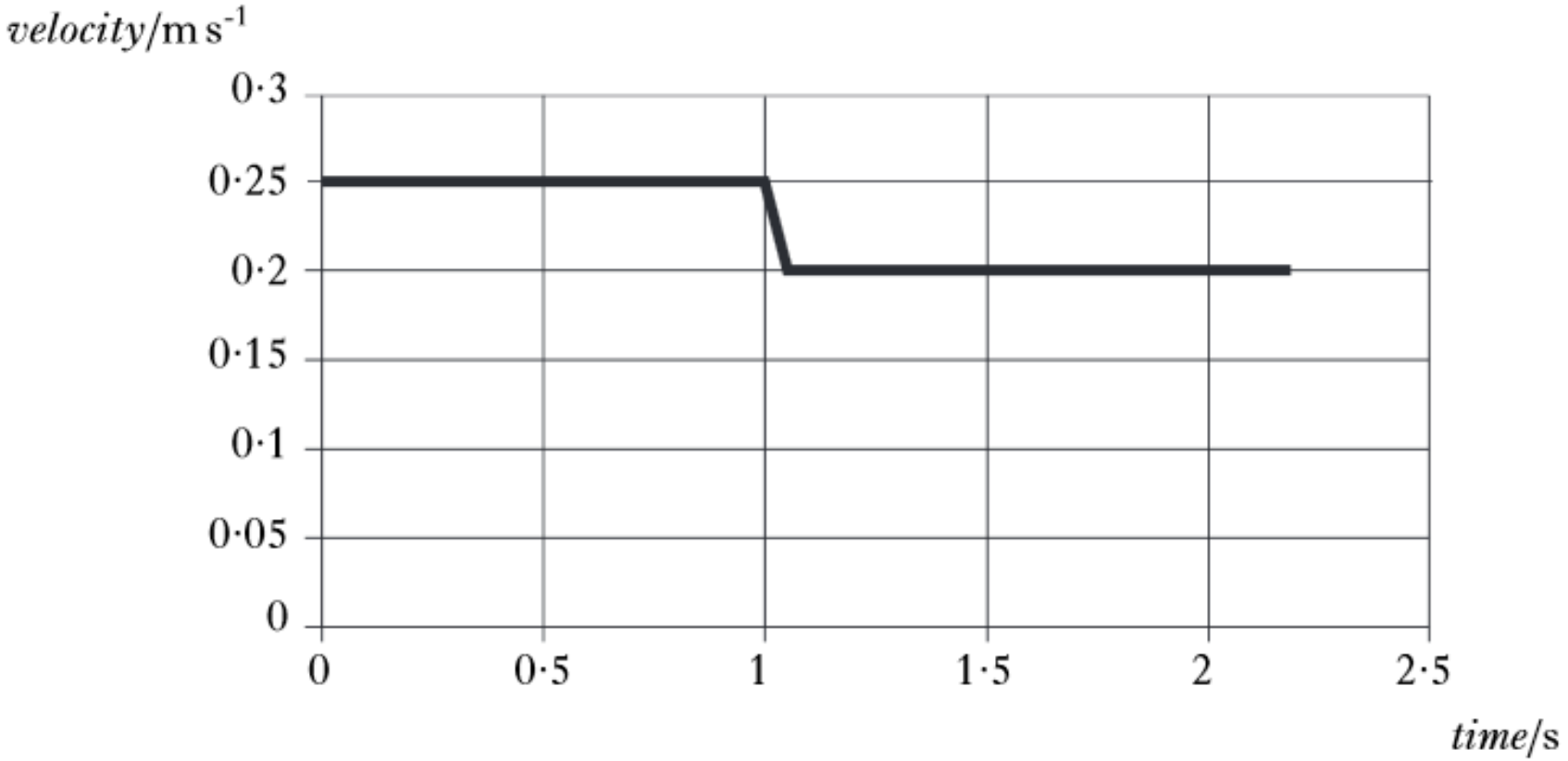


The mass of vehicle A is 0·22 kg and the mass of vehicle B is 0·16 kg.

The effects of friction are negligible.

Q20 continued

(*a*) During one experiment the vehicles collide and stick together. The computer connected to the motion sensor displays the velocity-time graph for vehicle A.



Q20 continued

(i) State the law of conservation of momentum.

(ii) Calculate the velocity of vehicle B before the collision.

Q20 continued

(*b*) The same apparatus is used to carry out a second experiment.

In this experiment, vehicle B is stationary before the collision.

Vehicle A has the same velocity before the collision as in the first experiment.

After the collision, the two vehicles stick together.

Is their combined velocity less than, equal to, or greater than that in the first collision?

Justify your answer.