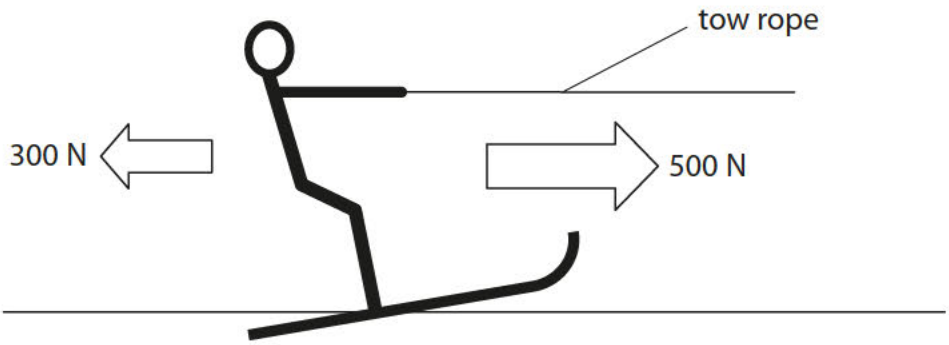
Water skiing

1 The photograph shows a water skier being pulled along by a boat.

(a) The diagram shows the horizontal forces acting on the water skier.



(i) The 500 N force is the force that the boat tow rope is exerting on the water skier.

Suggest what causes the 300 N force.

(1)

.....

(ii) Calculate the resultant of these two forces.

(2)

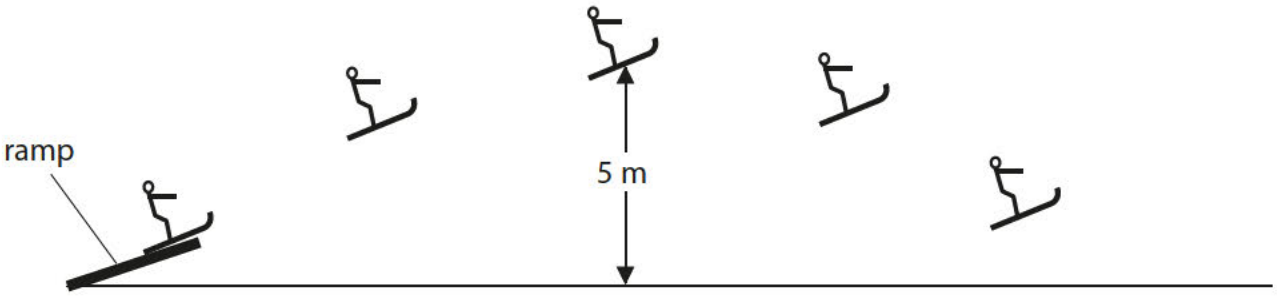
resultant force = ... N

(iii) State the direction of the resultant of these two forces.

(1)

.....

(b) The diagram shows the water skier using a ramp to perform a jump.
During the jump, she gains gravitational potential energy.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The unit of gravitational potential energy is

(1)

☐ **A** A

☐ **B** J

☐ **C** N

☐ **D** W

(ii) The mass of the water skier is 54 kg.
At the top of the jump, she is 5 m above the water level.

Calculate the amount of gravitational potential energy she gains in rising 5 m.
Gravitational field strength = 10 N/kg

(2)

gain in gravitational potential energy = ...

(iii) When the water skier reaches the top of the ramp, she lets go of the rope.

Describe the energy changes that happen between the skier leaving the ramp and reaching the top of the jump.

(2)

.....

.....

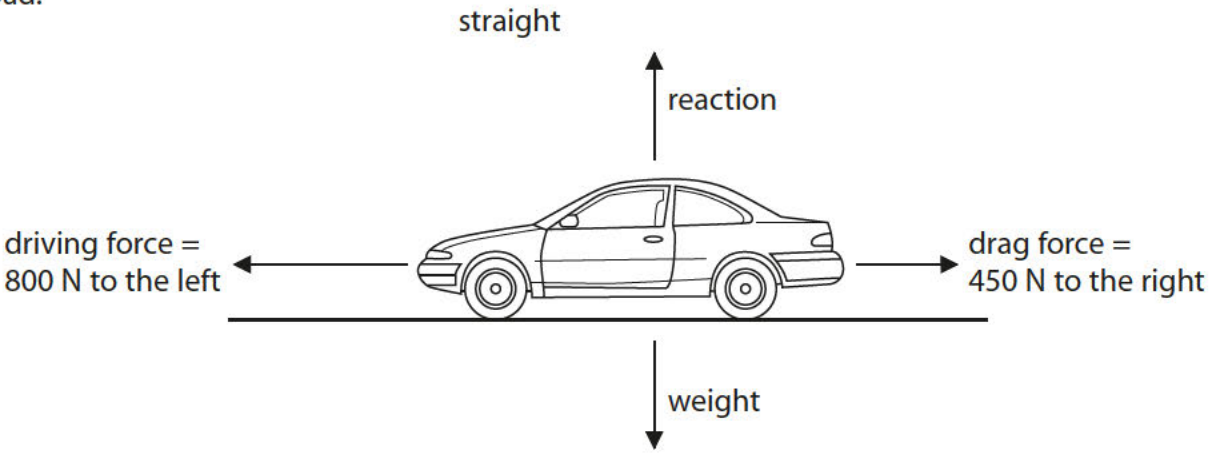
.....

.....

(Total for Question = 9 marks)

Motion and forces

2 The diagram shows the forces acting on a car which is travelling along a flat road.



(a) (i) The size of the resultant force on the car is 350 N.

In which direction is the resultant force acting?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** down ↓
- ☐ **B** to the left ←
- ☐ **C** to the right →
- ☐ **D** up ↑

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The car is

(1)

- ☐ **A** accelerating
- ☐ **B** decelerating
- ☐ **C** moving at a constant speed
- ☐ **D** not moving

(iii) The mass of the car is 625 kg.

Calculate the weight of the car.

gravitational field strength = 10N/kg

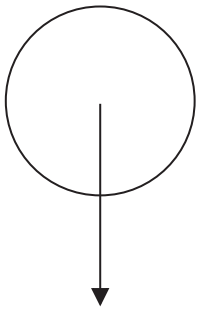
(2)

weight of car = ... N

(b) Forces also act on objects when they fall through the air.

There are two forces acting on this ball as it falls through the air.

The weight is shown on the diagram.



(i) Draw and label an arrow on the diagram to show the other force acting on the ball.

(2)

(ii) Use words from the box to complete the sentences.

(2)

balanced	cha ing	reater	small	ero

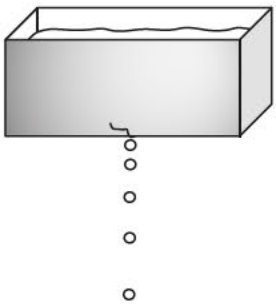
After a short time the ball falls at a steady speed.

The forces acting on the ball are now ..... .

The acceleration of the ball is now ..... .

(Total for Question = 8 marks)

3 A water tank drips water.



(a) Scientists could use four quantities to describe the movement of the water drops.
Three of these quantities are vectors.
The other quantity is a scalar.

acceleration	orce	mas	elocity

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The scalar quantity is

(1)

☐ **A** acceleration

☐ **B** force

☐ **C** mass

☐ **D** velocity

(ii) Complete the following sentence using one of the quantities from the word box above.

(1)

In a vacuum, all bodies falling towards the Earth's surface

have the same ..... .

(b) The mass of one water drop is 0.000 08 kg.

Calculate its weight.

(gravitational field strength is 10 N/kg)

(2)

weight = ... N

(c) The water drop falls to the ground, 13 m below, in 1.7 s.

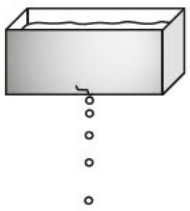
Calculate the average speed of the drop while it is falling.

(2)

average speed = ... m/s

*(d) The tank is a long way above the ground.
It drips at a steady rate.

The first drawing shows water drops which have just left the tank.
The second drawing shows water drops which are near to the ground.



drops leaving the tank

drops near to the ground

Explain why the drops which are near to the ground are an equal distance apart but the drops which have just started to fall are not.

(6)

(Total for Question = 12 marks)

4 (a) A car accelerates at a constant rate of 1.83 m/s^2 along a flat straight road.

The force acting on the car is 1.870 kN.

Calculate the mass of the car.

Give your answer to three significant figures.

(3)

mass = ... kg

(b) The car accelerates from rest for 16 s.

Calculate the speed of the car after 16 s.

(3)

speed = ... m/s

(c) The car starts on

Figure 6 shows the graph of the car's movement.

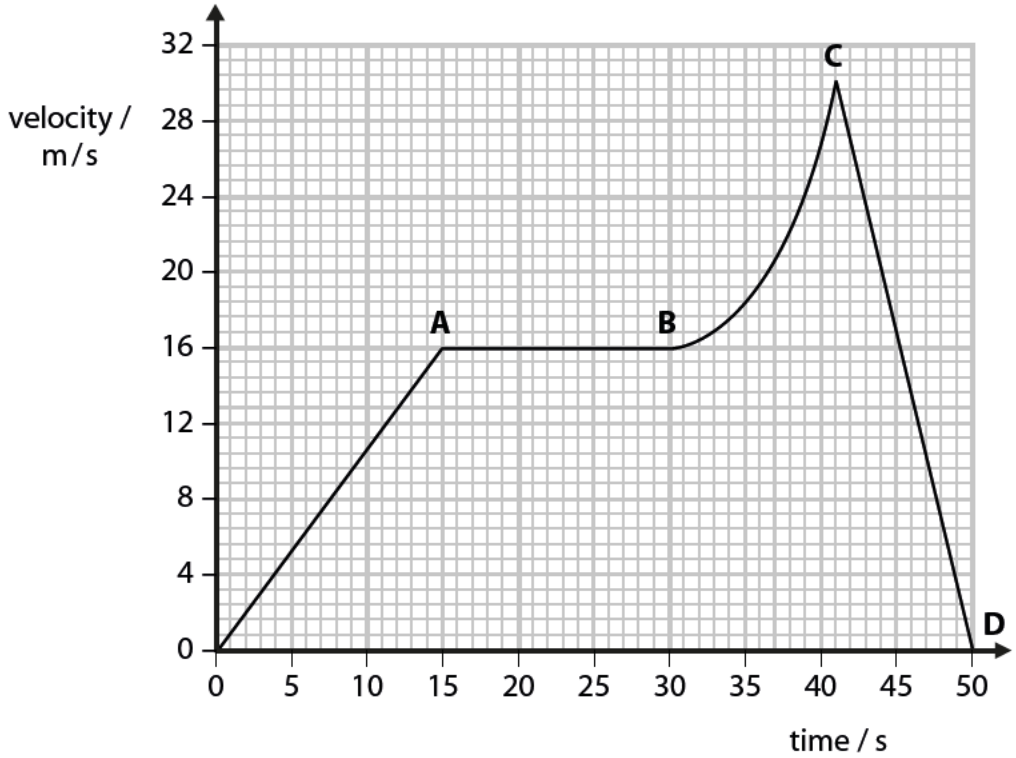


Figure 6

Show that the distance travelled when the car is moving at a constant speed is greater than the distance travelled when the car is slowing down.

(4)

(Total for Question = 10 marks)