PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



EXAM QUESTION PACK

TOPIC 9: FORCES AND THEIR EFFECTS (PAPER 2)

SCORE	PERCENTAGE
/92	%

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Q1.

The extension of the spring in Figure 10b is now determined for different weights added to the spring up to a maximum of 6 N.

Figure 11 shows a graph of the results.

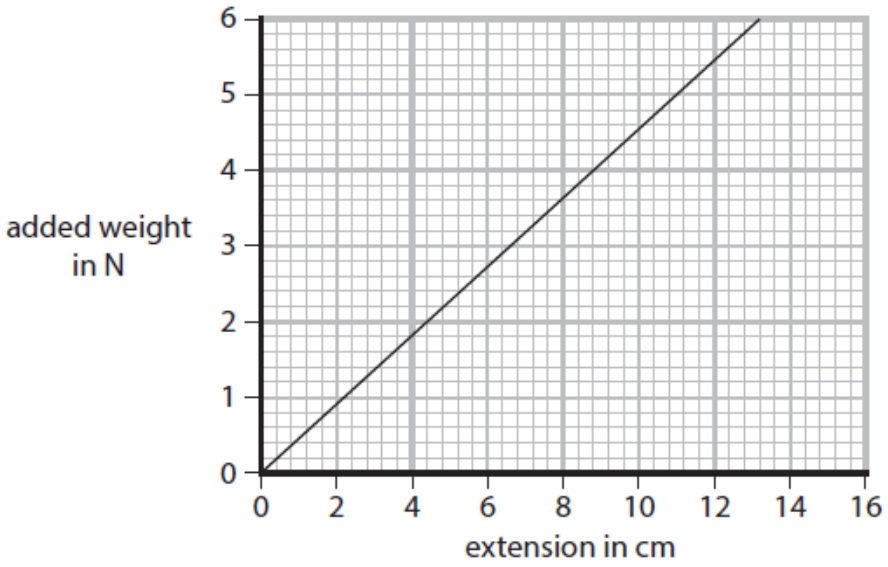


Figure 11

(i) The increase in potential energy stored in the spring is equal to the area under the graph in Figure 11.

Calculate the increase in potential energy stored in the spring when the spring is extended from 0 cm to 8 cm.

Give your answer in joules (J).

(3)

energy = ... J

(ii) Calculate the spring constant of the spring using data from the graph in Figure 11.

State the unit.

(2)

spring constant = ... unit
.....

(iii) The box in Figure 12 represents a weight added to the end of the spring.



Figure 12

Draw **two** vectors on Figure 12 to complete a free body force diagram of a 5 N weight in equilibrium.

(2)

(Total for question = 7 marks)

(**QU05b 1SC0/2PH, June 2025**)

Q2.

Figure 9 shows two forces, P and Q, acting at point X.

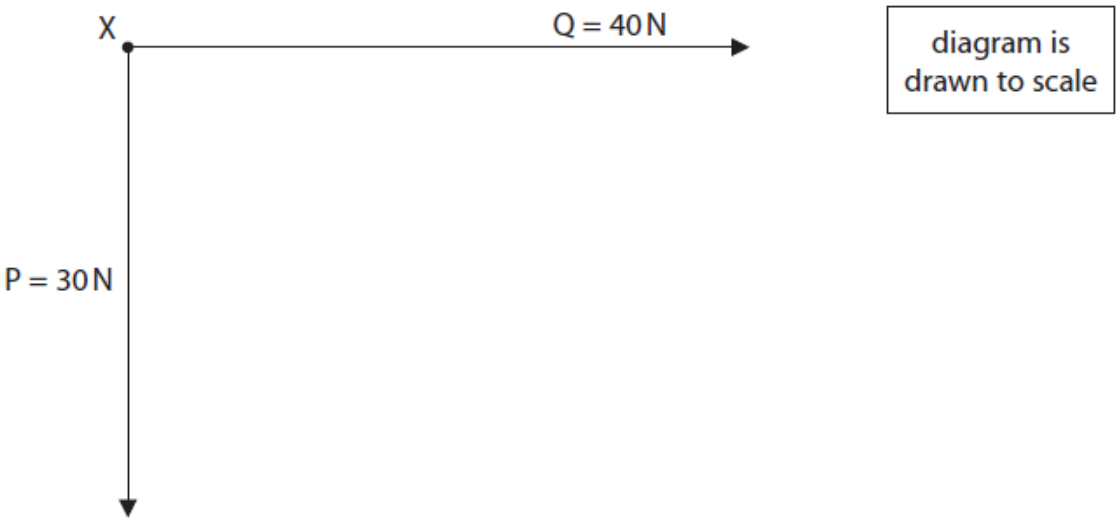


Figure 9

Complete the diagram in Figure 9 to show the size and direction of the resultant force, R, on point X.

(Total for question = 2 marks)

(**QU04c 1SC0/2PH, June 2023**)

Q3.

Figure 13 shows two forces, P and Q, acting at point X.

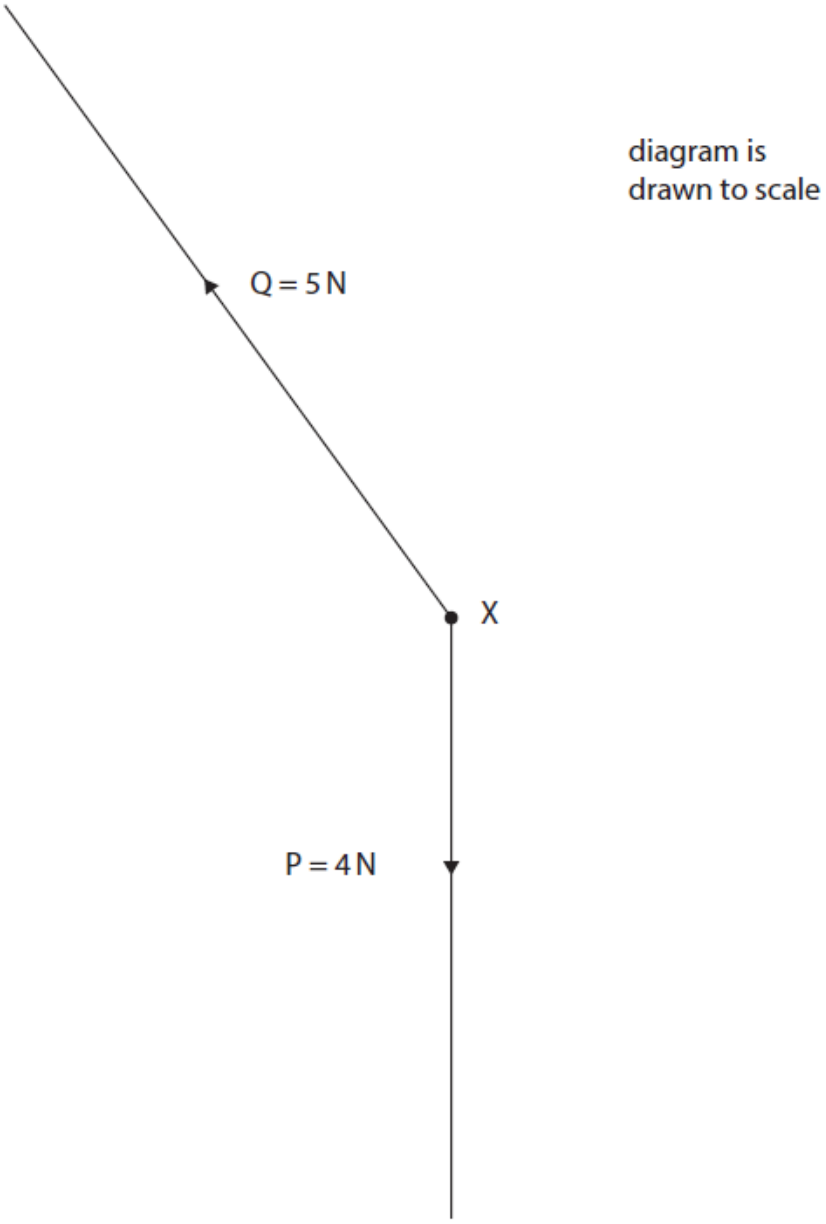


Figure 13

Complete the diagram in Figure 13 to show the size and direction of the resultant force, R, on point X.

(2)

(Total for question = 2 marks)

(**QU05c 1SC0/2PH, June 2025**)

Q4.

Figure 8 shows a demolition ball of mass 400 kg.

The ball is used to demolish a wall.

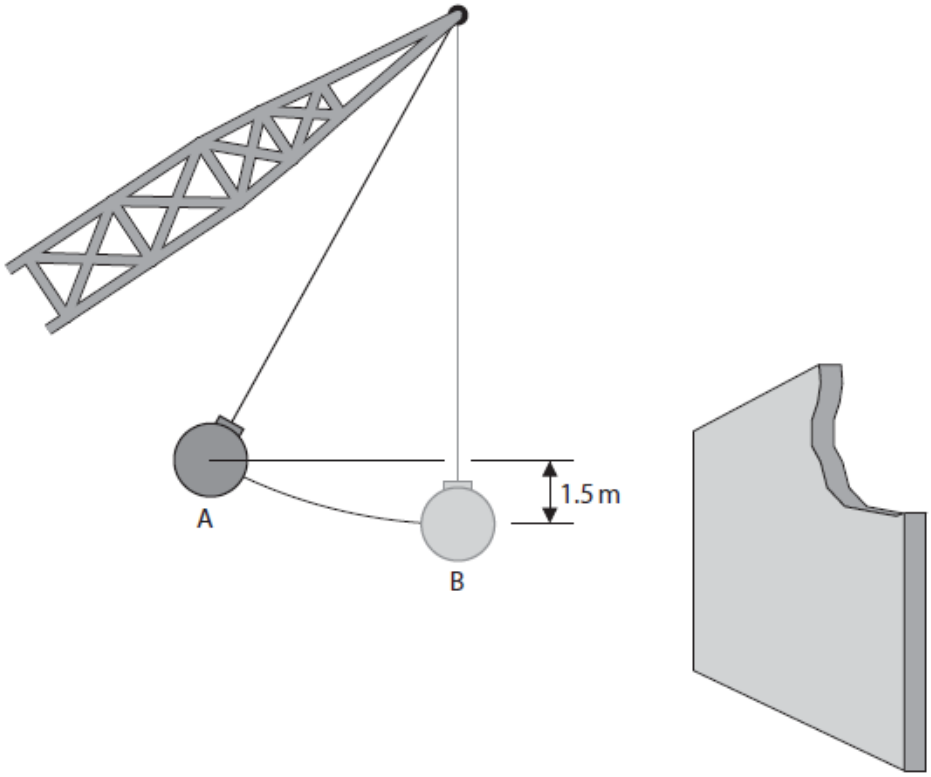


Figure 8

As the ball swings from A to B, it moves through a vertical height of 1.5 m.

(i) Calculate the change in gravitational potential energy.

Take gravitational field strength, g, to be 10 N/kg.

(3)

(ii) The heavy ball comes to rest soon after smashing into the wall. In doing this, the temperatures of the ball, wall and surroundings all increase slightly.

Explain this observation.

(2)

.....

.....

.....

.....

(iii) Which of these quantities of the ball changes in **both** magnitude and direction while the ball is swinging?

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

(1)

☒ **A** gravitational potential energy

☒ **B** velocity

☒ **C** the gravitational force acting

☒ **D** kinetic energy

(Total for question = 6 marks)

(**Q06a 1SC0/2PH/S2, SAM**)

Q5.

Some forces act at a distance.

One example is the gravitational attraction between the Moon and the Earth.

Describe an example of another type of force acting at a distance, where the force is **not** gravitational.

(2)

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.....

(Total for question = 2 marks)

(**Q05a 1SC0/2PF/S2, SAM**)

Q6.

Some forces act at a distance.

One example is the gravitational attraction between the Moon and the Earth.

Describe an example of another type of force acting at a distance, where the force is **not** gravitational.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

(**Q01a 1SC0/2PH/S2, SAM**)

Q7.

Figure 4 shows a toy that has a plastic cylinder, a plastic base and two similar magnets. Each of the two magnets is in the shape of a ring.

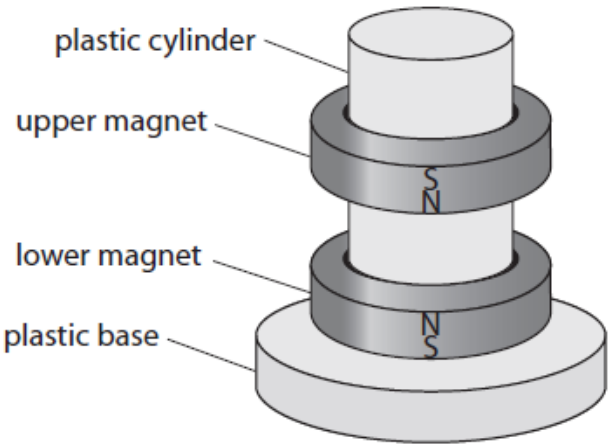


Figure 4

The upper magnet seems to float in the air above the lower magnet.

Describe the forces acting on the upper magnet.

Use the idea of magnetic fields in your answer.

(3)

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.....

(Total for question = 3 marks)

(**QU03b 1SC0/2PH, June 2023**)

Q8.

Figure 13 shows a drone.



© Liubov Kotliar/123RF

Figure 13

The drone has four spinning blades.

The upward force produced enables the drone to rise in the air.

The speed at which the blades spin is measured in turns per minute.

Figure 14 shows how the upward force produced by the four blades depends on the speed at which the blades spin.

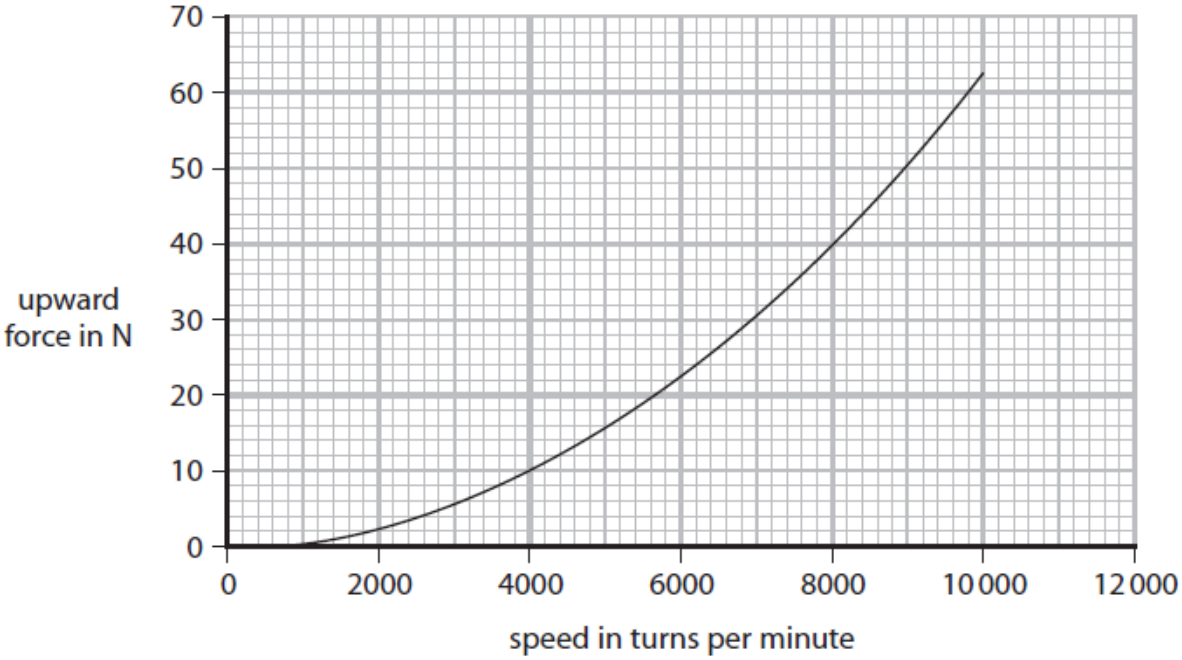


Figure 14

Describe the relationship between upward force and speed shown by this graph.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

(**Q06a 1SC0/2PF, Nov 2020**)

Q9.

Figure 4 shows a drone.



© Liubov Kotliar/123RF

Figure 4

The drone has four spinning blades.

The upward force produced enables the drone to rise in the air.

The speed at which the blades spin is measured in turns per minute.

Figure 5 shows how the upward force produced by the four blades depends on the speed at which the blades spin.

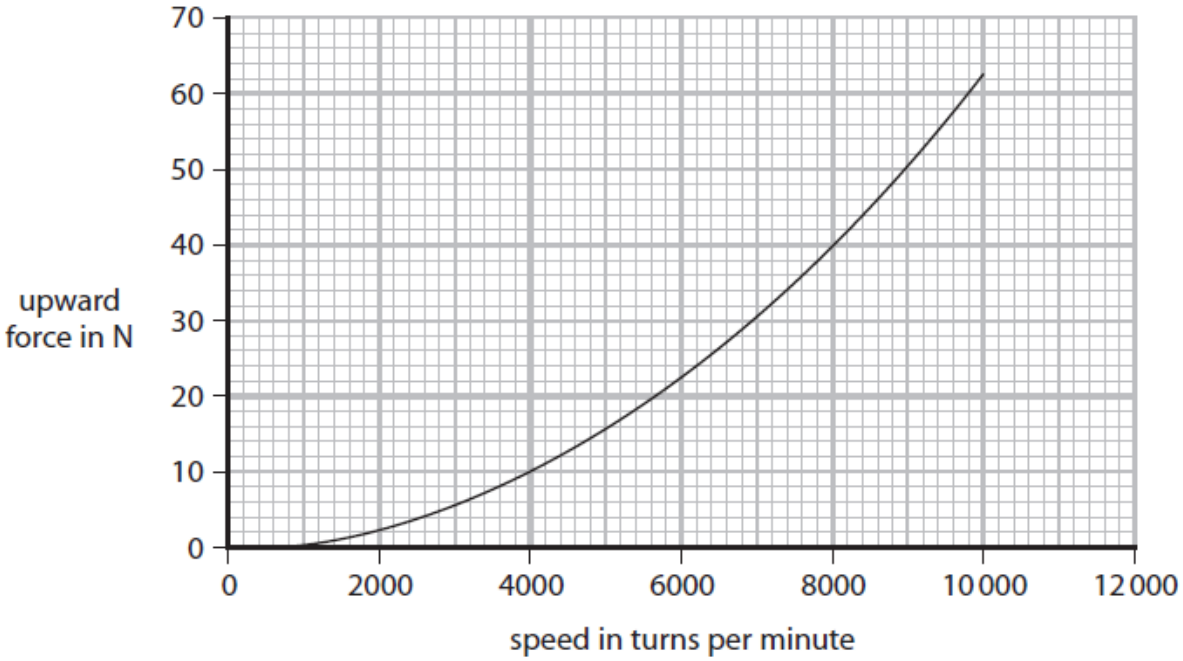


Figure 5

Describe the relationship between upward force and speed shown by this graph.

(2)

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(Total for question = 2 marks)

(**Q02a 1SC0/2PH, Nov 2020**)

Q10.

Figure 14 shows two small boats pulling a much larger ship.

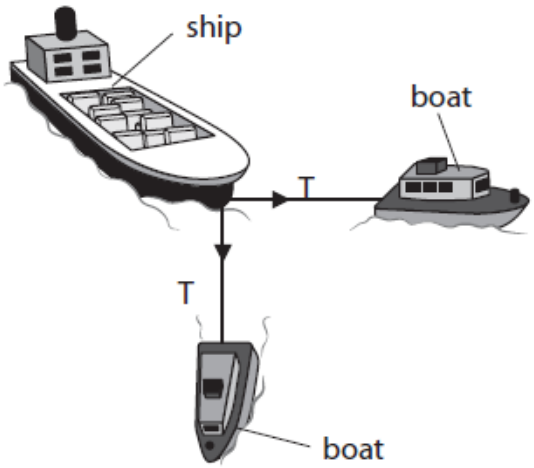


Figure 14

The ship is connected to the boats with ropes.

The tension, T, in each of the ropes has a magnitude of 20 kN.

The ropes are at right angles to each other.

Draw a vector diagram and use it to determine the resultant force that the boats exert on the ship.

(4)

magnitude of resultant force on the ship = ... kN

(Total for question = 4 marks)

(**Q06b 1SC0/2PH, Nov 2020**)

Q11.

Figure 4 shows two astronauts in space pushing at a satellite.

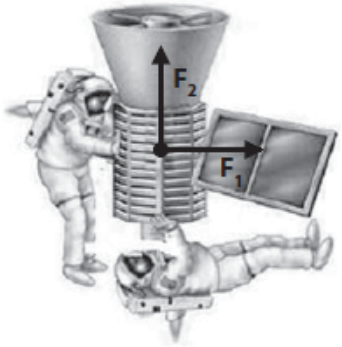
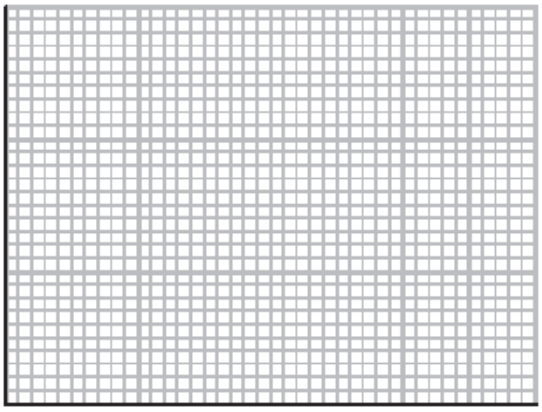


Figure 4

(i) The force F_1 is 3.0 N and the force F_2 is 2.0 N, acting at right angles to each other.

Draw a vector diagram to scale showing these forces.

(2)



(ii) Use the diagram in (i) to estimate the magnitude of the resultant force acting on the satellite.

(2)

resultant force = ... N

(Total for question = 4 marks)

(**Q03d 1SC0/2PH/S2, SAM**)

Q12.

Figure 15 shows a wooden block connected to a weight by a string.
The string goes over a pulley.

The surfaces of the table and the wooden block are both rough.

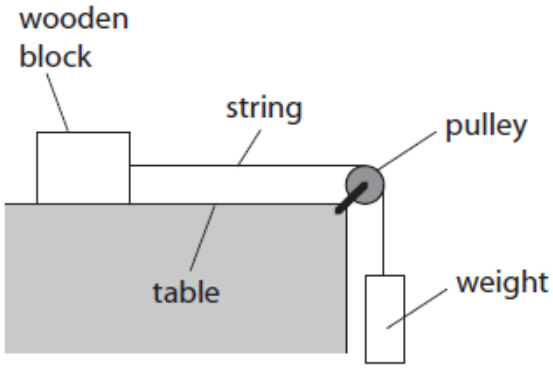


Figure 15

The wooden block moves across the table at a constant horizontal velocity.

Several vertical and horizontal forces act on the wooden block as it moves.

Explain how the forces keep the wooden block moving across the table at a constant horizontal velocity.

Your answer should refer to all forces acting on the wooden block.

You may add to the diagram to help with your answer.

(6)

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(Total for question = 6 marks)

Q13.

A student places a trolley at the top of a runway, as shown in Figure 9.

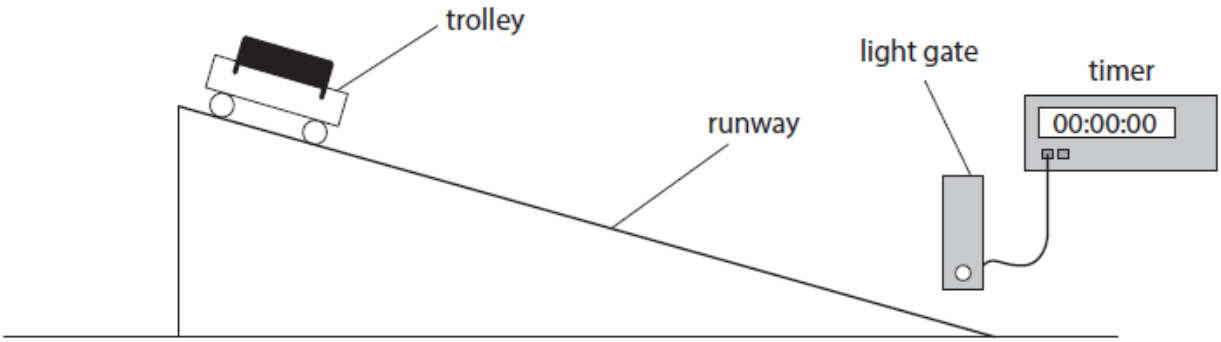


Figure 9

The student had to lift the trolley through a height of 26 cm to put it at the top of the runway.

The gravitational potential energy, Δ*GPE*, of the trolley increases by 4.1 J when lifted to the top of the runway.

The gravitational field strength, g, = 10 N/kg.

(i) Show that the mass of the trolley is about 1.6 kg.

Use the equation

$$m = \frac{\Delta GPE}{g \times \Delta h}$$

(2)

(ii) The student releases the trolley and the trolley moves down the runway.

The student assumes that all the extra gravitational potential energy, Δ*GPE*, stored at the top of the runway is transferred to kinetic energy at the end of the runway.

Calculate the expected value of the velocity of the trolley at the end of the runway.

Use the equation

$$v^2 = \frac{2 \times \Delta GPE}{m}$$

(3)

expected velocity = ... m/s

(iii) The light gate, shown in Figure 9, is used to determine the actual velocity of the trolley at the end of the runway.

The actual velocity at the end of the runway is less than the expected velocity as calculated in part (ii).

Suggest **one** way to reduce the difference between the actual velocity and the expected velocity.

(1)

.....

.....

(Total for question = 6 marks)

(**QU05a 1SC0/2PF, June 2025**)

Q14.

A student places a trolley at the top of a runway, as shown in Figure 1.

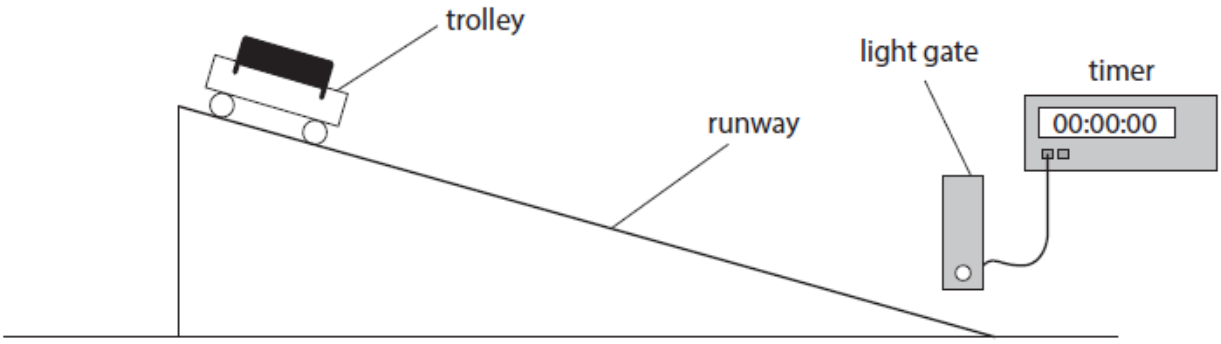


Figure 1

The student had to lift the trolley through a height of 26 cm to put it at the top of the runway.

The gravitational potential energy, ΔGPE, of the trolley increases by 4.1 J when lifted to the top of the runway.

The gravitational field strength, g, = 10 N/kg.

(i) Show that the mass of the trolley is about 1.6 kg.

Use the equation

$$m = \frac{\Delta GPE}{g \times \Delta h}$$

(2)

(ii) The student releases the trolley and the trolley moves down the runway.

The student assumes that all the extra gravitational potential energy, Δ*GPE*, stored at the top of the runway is transferred to kinetic energy at the end of the runway.

Calculate the expected value of the velocity of the trolley at the end of the runway.

Use the equation

$$v^2 = \frac{2 \times \Delta GPE}{m}$$

(3)

expected velocity = ... m/s

(iii) The light gate, shown in Figure 1, is used to determine the actual velocity of the trolley at the end of the runway.

The actual velocity at the end of the runway is less than the expected velocity as calculated in part (ii).

Suggest **one** way to reduce the difference between the actual velocity and the expected velocity.

(1)

.....

.....

(Total for question = 6 marks)

(**QU01a 1SC0/2PH, June 2025**)

Q15.

(i) Figure 14 shows the vertical forces on an aeroplane.

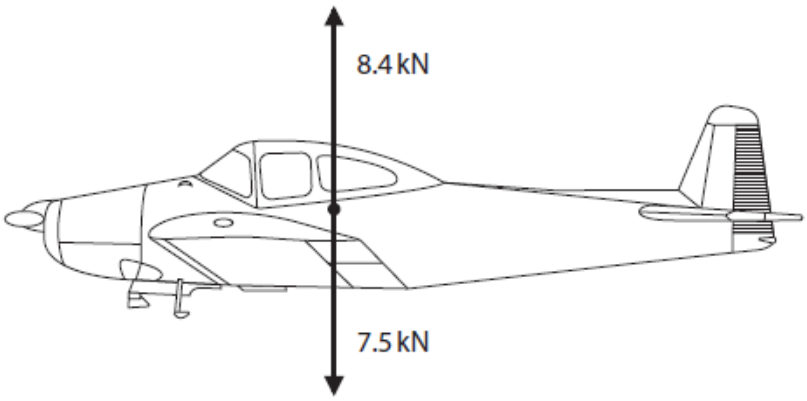


Figure 14

Use information from the diagram to determine the size and direction of the resultant vertical force on the aeroplane.

(2)

size = ... kN, direction is .....

(ii) The aeroplane is descending.

Figure 15 shows a diagram of the resultant vertical and horizontal forces on the aeroplane as it is descending.

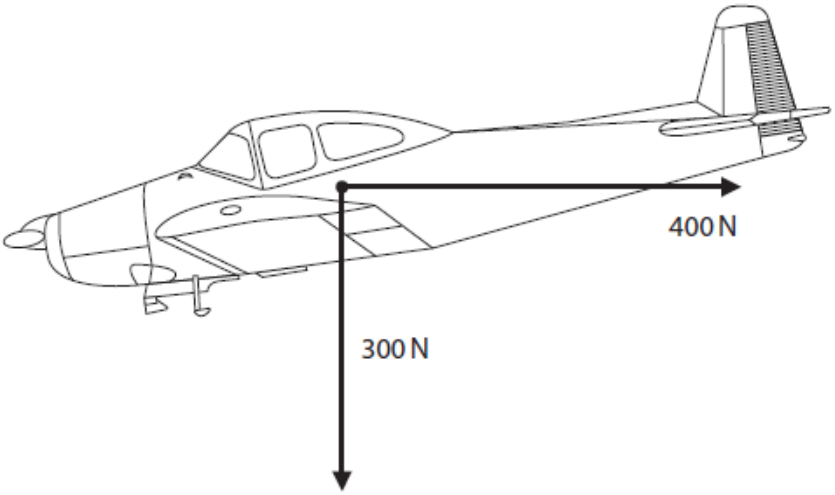


Figure 15

Complete the diagram to show the resultant of these two forces.

(1)

(iii) The mass of the aeroplane is 750 kg.

Calculate the change in gravitational potential energy of the aeroplane as it descends from 1300 m to the ground.

Gravitational field strength (g) = 10 N/kg

(2)

energy = ... J

(Total for question = 5 marks)

(**Q10 1SC0/2PH, June 2018**)

Q16.

(i) Which of these forces keeps the Moon moving around the Earth?

(1)

☒ **A** contact

☒ **B** electrostatic

☒ **C** gravitational

☒ **D** magnetic

(ii) Which of these is a scalar quantity?

(1)

☒ **A** velocity

☒ **B** momentum

☒ **C** energy

☒ **D** acceleration

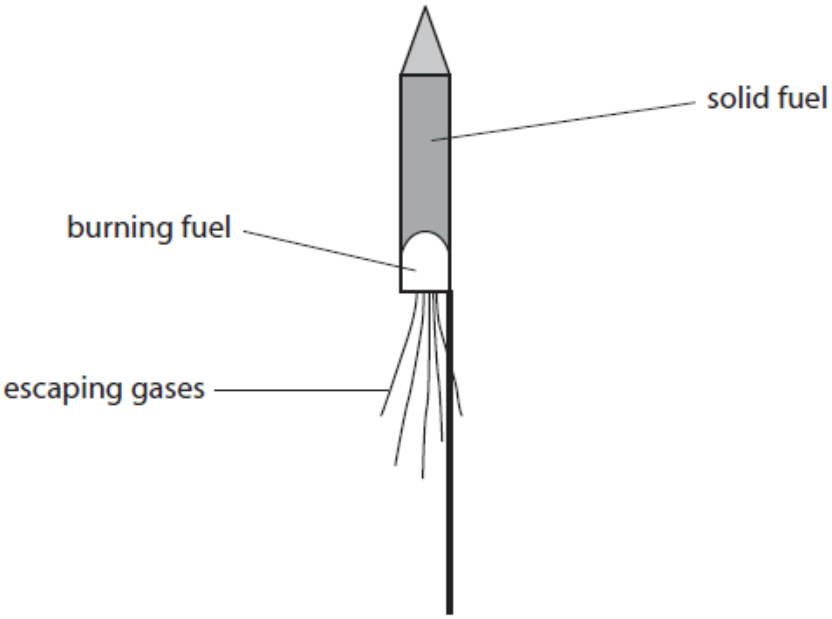
(Total for question = 2 marks)

(**Q09 1SC0/2PF, June 2018**)

Q17.

A firework rocket contains a solid fuel inside a cardboard tube.

The burning of the fuel creates a thrust to propel the rocket upwards.



(i) Scientists can refer to several different quantities when describing the motion of the rocket.

mass	energy	speed	force

Only one of these quantities is a vector.

Complete this sentence using **one** of the words from the box.

(1)

The vector quantity is .....

(ii) Before the fuse is lit, the total weight of a rocket including fuel is 0.7N.

The gravitational field strength is 10 N/kg.

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

The total mass of the rocket including fuel is

(1)

☒ **A** 0.007 kg

☒ **B** 0.07 kg

☒ **C** 0.7 kg

☒ **D** 7 kg

(iii) There is a resultant force on the rocket of 0.5 N upwards when it takes off.

The arrow on the diagram shows the size and direction of the force of gravity acting on the rocket when it takes off.



Add another arrow to the diagram to show the thrust produced by the burning fuel at the time the rocket takes off.

You should label the arrow with the size of the thrust.

(2)

(**Q02 1SC0/2PH, June 2015**)

Q18.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Two cyclists ride on a hilly road and go through points P, Q, R and S.

The diagram in Figure 7 shows how the vertical height of the road changes during the journey from P to S.

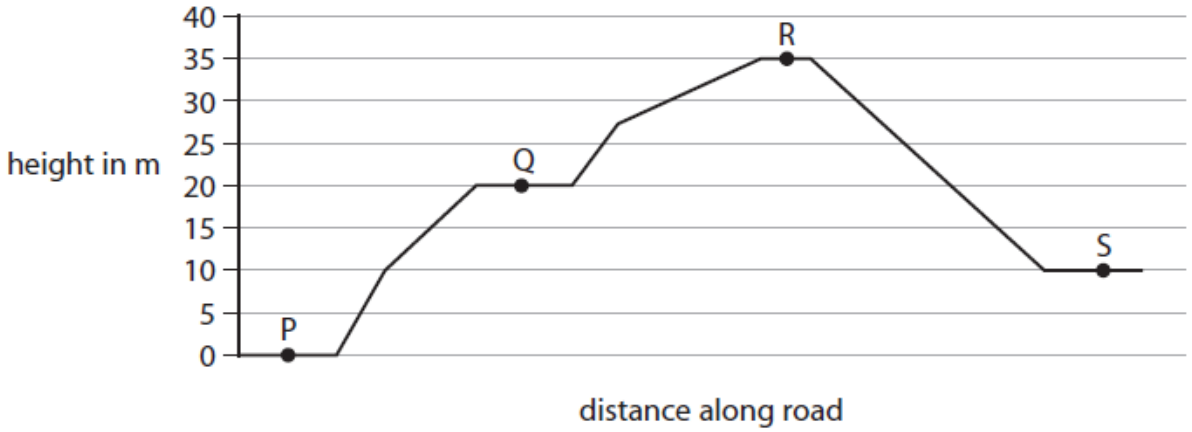


Figure 7

(i) The greatest overall change in gravitational potential energy for each cyclist is between which two points on the journey?

(1)

☒ **A** P and Q

☒ **B** Q and R

☒ **C** P and S

☒ **D** R and S

(ii) The total weight of one cyclist and bicycle is 700 N.

Calculate the total amount of work done against gravity when the cyclist travels from point P to point Q in the journey.

(2)

work done = ... J

(iii) The gravitational potential energy of the other cyclist changes by 11 250 J when travelling from point Q to point R.

Calculate the mass of this cyclist.

Gravitational field strength = 10 N / kg

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

(2)

mass = ... kg

(iv) Explain why the total amount of work done by a cyclist between points Q and R is different from the change in gravitational potential energy of the cyclist between points Q and R.

(2)

.....

.....

.....

.....

(v) The cyclists lubricated the chains and the wheel bearings of their bicycles before setting off.

Lubricating the chains and wheel bearings helps to

(1)

☒

A decrease the amount of work done against gravity

☒ **B** decrease the efficiency of the cyclist and bicycle

☒ **C** increase the efficiency of the cyclist and bicycle

☒ **D** increase the overall amount of energy transferred by the cyclist

(Total for question = 8 marks)

(**Q04a 1SC0/2PH, Nov 2021**)

Q19.

Explain how unwanted energy transfers may be reduced in mechanical systems.

(2)

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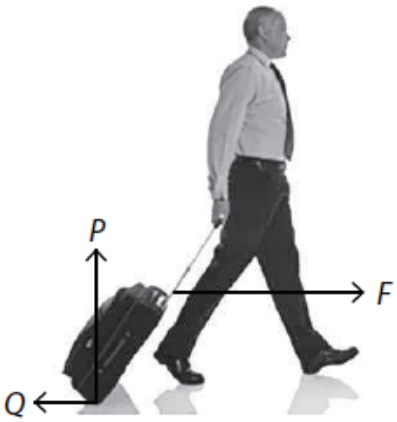
(Total for question = 2 marks)

(**Q03a 1SC0/2PH/S2, SAM**)

Q20.

A man pulls a suitcase with a horizontal force, *F*, as shown in Figure 10.

Two other forces acting on the suitcase are labelled *P* and *Q*.



Not to scale

Figure 10

(i) Which of these gives the correct names for the forces *P* and *Q*?

(1)

		name of	
		force *P*	force *Q*
☒	**A**	upthrust	reaction
☒	**B**	reaction	friction
☒	**C**	reaction	reaction
☒	**D**	friction	upthrust

(ii) Draw an arrow on the diagram to represent the weight of the suitcase.

(1)

(Total for question = 2 marks)

(**Q03a 1SC0/2PF, SAM 2016**)

Q21.

Figure 3 shows a book resting on a table with some forces involved.

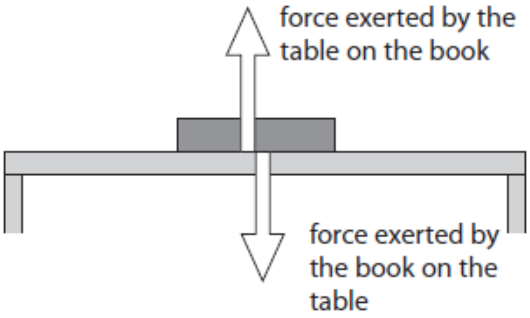


Figure 3

State why this diagram is **NOT** a free body force diagram.

(1)

.....

.....

(Total for question = 1 mark)

(**Q03c 1SC0/2PH/S2, SAM**)

Q22.

In which of the following situations is a non-zero resultant force acting?

(1)

☒ **A** a book rests on a table

☒ **B** a car travels along a road at a constant speed

☒ **C** a javelin moves through the air after leaving an athlete's hand

☒ **D** a steel ball bearing descends through some car oil at a constant velocity

(Total for question = 1 mark)

(**Q03b 1SC0/2PH/S2, SAM**)

Q23.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The magnitude and direction of a force can be represented by a vector.
Figure 13 shows the forces acting on four identical trolleys. The arrows show the magnitude and direction of the forces.

Which diagram shows a pair of forces that will produce zero acceleration?

(1)

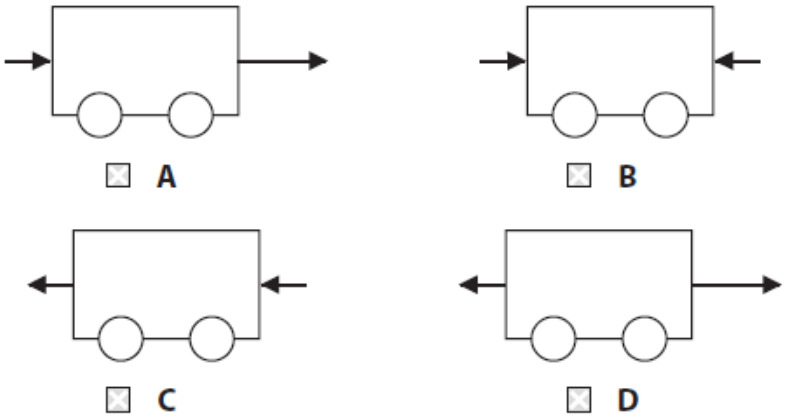


Figure 13

(Total for question = 1 mark)

(**Q06a 1SC0/2PH, Nov 2020**)

Q24.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 8 shows a different spring hanging from a hook fixed to the ceiling.

A block hangs from the other end of the spring.

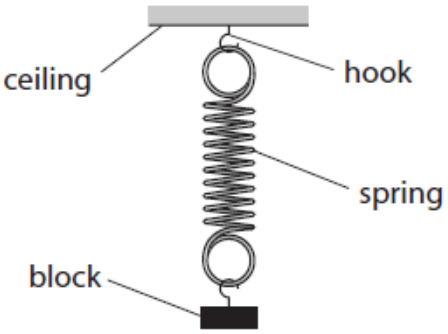


Figure 8

The weight of the spring is 1 N.
The weight of the block is 5 N.

The force exerted on the top of the spring by the hook is

(1)

☒ **A** 4 N down

☒ **B** 4 N up

☒ **C** 6 N down

☒ **D** 6 N up

(Total for question = 1 mark)

(**QU04b 1SC0/2PH, June 2023**)

Q25.

A student investigates the forces between the trucks in the toy railway.

She places four trucks in a row.

She pulls truck **Z** in the direction shown by the arrow.

The whole train travels at a constant speed as shown in Figure 17.

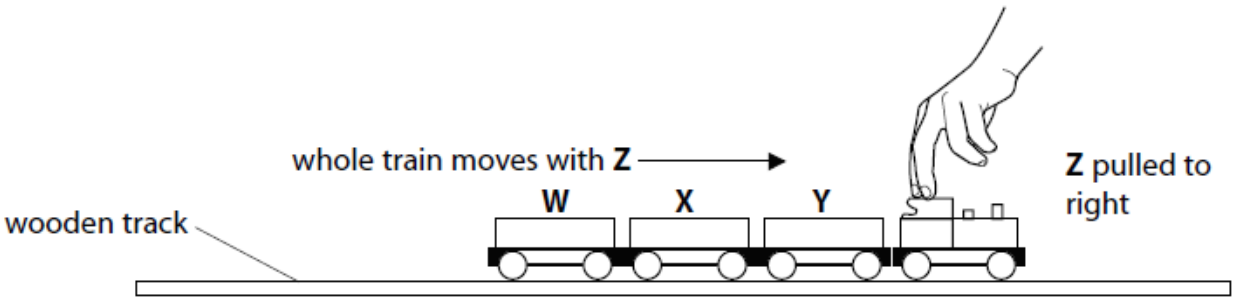


Figure 17

The student repeats this method of adding trucks and pulling the train each time.

When there are seven trucks in total, the train comes apart between **Y** and **Z** when tested as shown in Figure 18.

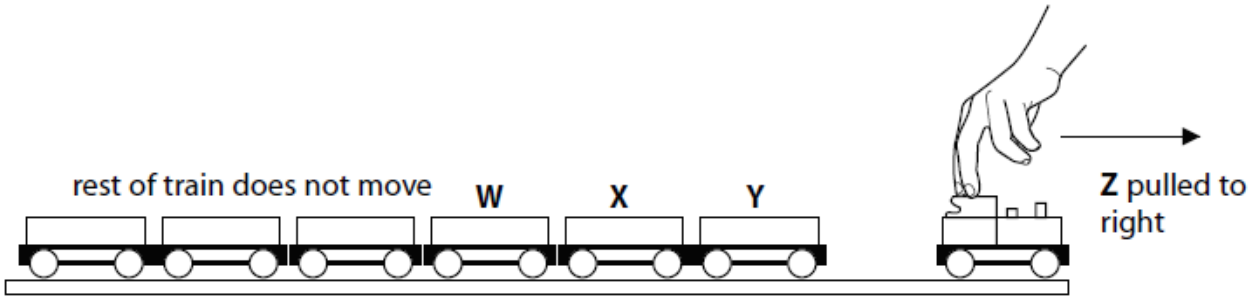


Figure 18

(i) Explain why the train acts in this way by considering the forces involved.

(2)

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(ii) Devise an experiment to investigate the horizontal force needed to separate the trucks from the engine.

(3)

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(iii) Explain why a larger force is needed to separate the trucks from the engine if the force is

applied at an angle to the horizontal.

(2)

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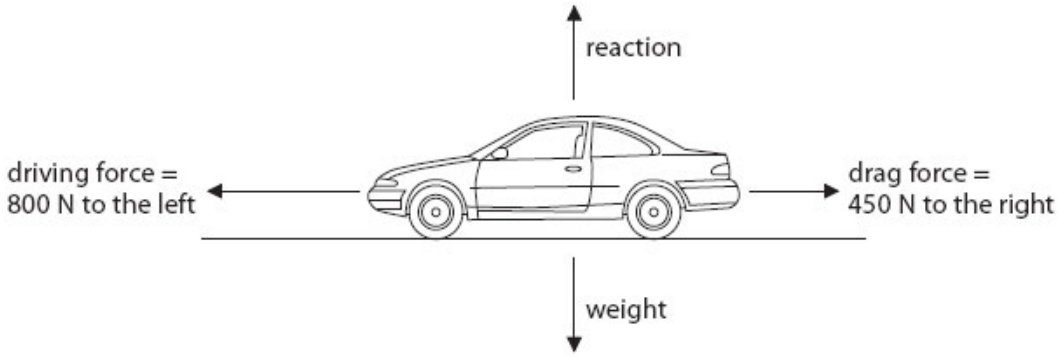
.....

(Total for question = 7 marks)

(**Q06c 1SC0/2PH, SAM 2016**)

Q26.

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



(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

(2)

(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

(**Q01 1SC0/2PH, Mar 2013**)

Q27.

Figure 5 shows a box sliding down a slope in the direction shown.

(3)

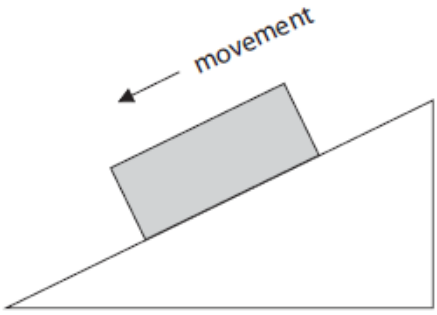


Figure 5

Draw two vector arrows on this diagram showing the 'normal contact force' and 'friction' acting on the box.
Label these two forces.

(Total for question = 3 marks)

(**Q03e 1SC0/2PH/S2, SAM**)

Q28.

Figure 8 shows part of a cart.

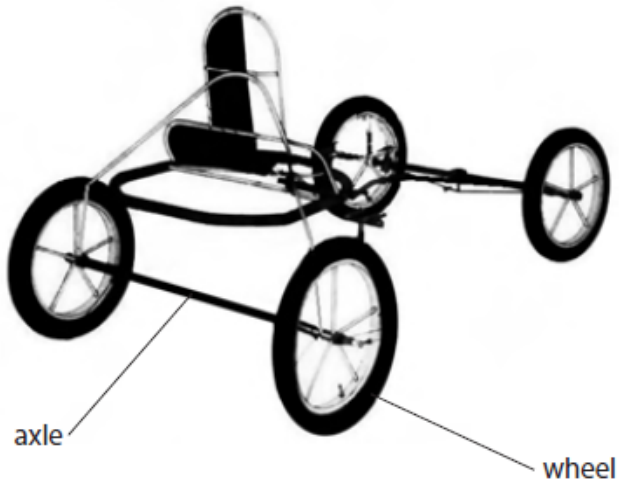


Figure 8

When the wheels turn the axles become warm.

(i) Explain why the axles become warm when the wheels turn.

(2)

.....

.....

.....

.....

(ii) Give **one** way of reducing the heating of the axles when the wheels turn.

(1)

.....

.....

(Total for question = 3 marks)

(Q11 1SC0/2PF, June 2018)

Q29.

Figure 7 shows a box at rest on a floor.

The force that the floor exerts on the box is shown by the vector in Figure 7.

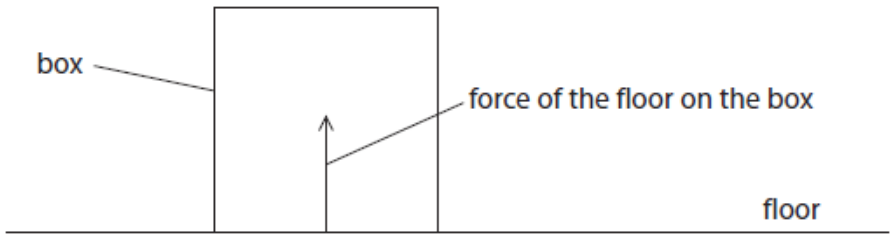


Figure 7

Add another vector to the diagram in Figure 7 to show the weight of the box.

(2)

(Total for question = 2 marks)

(Q10 1SC0/2PF, June 2018)