PEARSON EDEXCEL IGCSE PHYSICS · 4PH1

PHYSICS



EXAM QUESTION PACK

SECTION 1: FORCES AND MOTION (PACK 2)

SCORE	PERCENTAGE
/314	%

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Q1.

(a) Diagram 1 shows a metal ball held at rest above the floor.

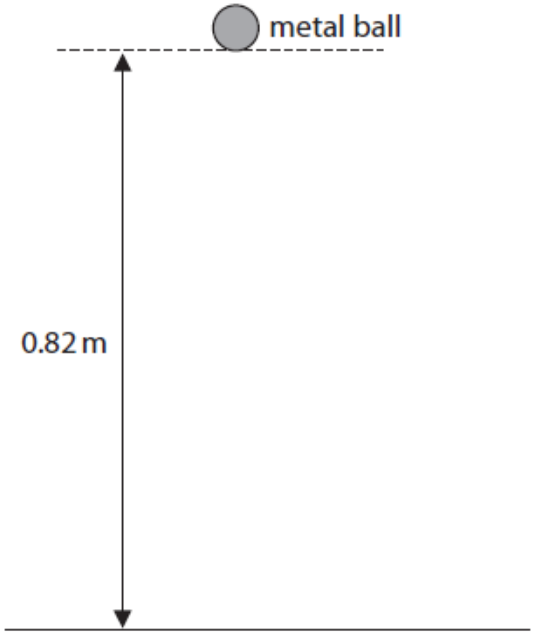


Diagram 1

The metal ball has a mass of 0.52 kg and is held at a height of 0.82 m above the floor.

(i) State the formula linking gravitational potential energy (GPE), mass, *g* and height.

(1)

(ii) Calculate the decrease in the metal ball's GPE store when the ball falls to the floor from this height.

(2)

decrease in GPE store = ... J

(iii) State the amount of energy in the metal ball's kinetic store just before it hits the floor.

Ignore the effects of air resistance.

(1)

energy in kinetic store = ... J

(iv) Calculate the speed of the metal ball just before it hits the floor.

(4)

speed = ... m/s

(b) The metal ball is dropped from rest again from the same height above the floor, as shown in diagram 2.

The metal ball now falls through a cylinder containing oil rather than the air.

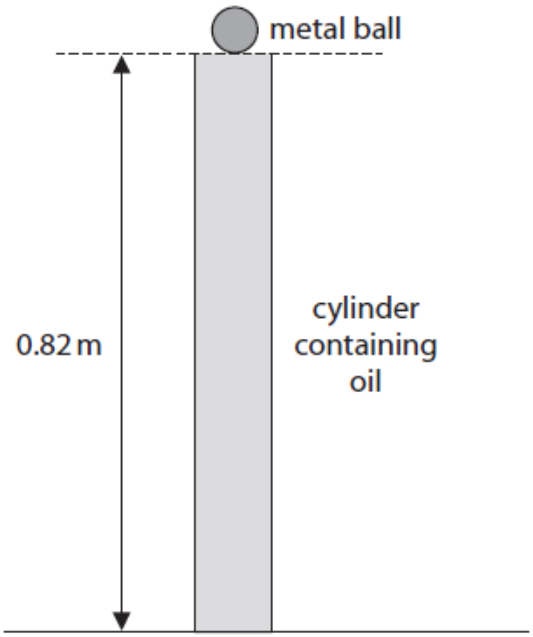


Diagram 2

The speed of the ball just before it hits the floor when moving in oil is less than the speed of the ball just before it hits the floor when moving in air.

Explain, using ideas about energy, the difference in speeds.

(3)

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(Total for question = 11 marks)

Q2.

This question is about a parachutist.

(a) A parachutist leaves a helicopter that is hovering above the ground.

The parachutist is initially at rest and falls vertically downwards.

Calculate the speed of the parachutist after they have fallen through a distance of 1300 m.

Ignore the effect of air resistance.

(4)

speed = ... m/s

(b) When the parachutist is much nearer to the ground, they open their parachute.

The parachutist slows down.

(i) Explain the change in speed of the parachutist.

Use ideas about forces in your answer.

(3)

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(ii) It is observed that from when the parachute opens to just before the parachutist touches the ground, the GPE store and the KE store of the parachutist both decrease, yet energy is still conserved.

Justify these observations.

(3)

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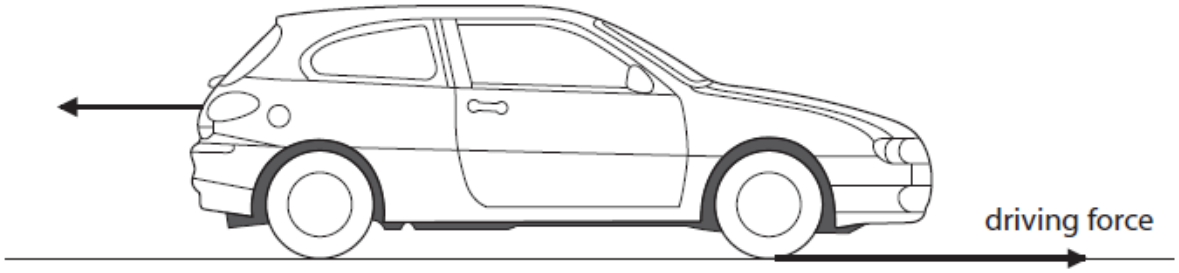
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(Total for question = 10 marks)

Q3.

(a) A car accelerates along a level road.

The diagram shows some of the horizontal forces acting on the car as it accelerates.



(Source: DEEWI114481 © father/Shutterstock)

(i) A driving force acts on the car, as shown in the diagram.

State the name of the other force shown in the diagram.

(1)

.....

(ii) State the formula linking unbalanced force, mass and acceleration.

(1)

(iii) The unbalanced force acting on the car is 2900 N.

The mass of the car is 1200 kg.

Calculate the acceleration of the car.

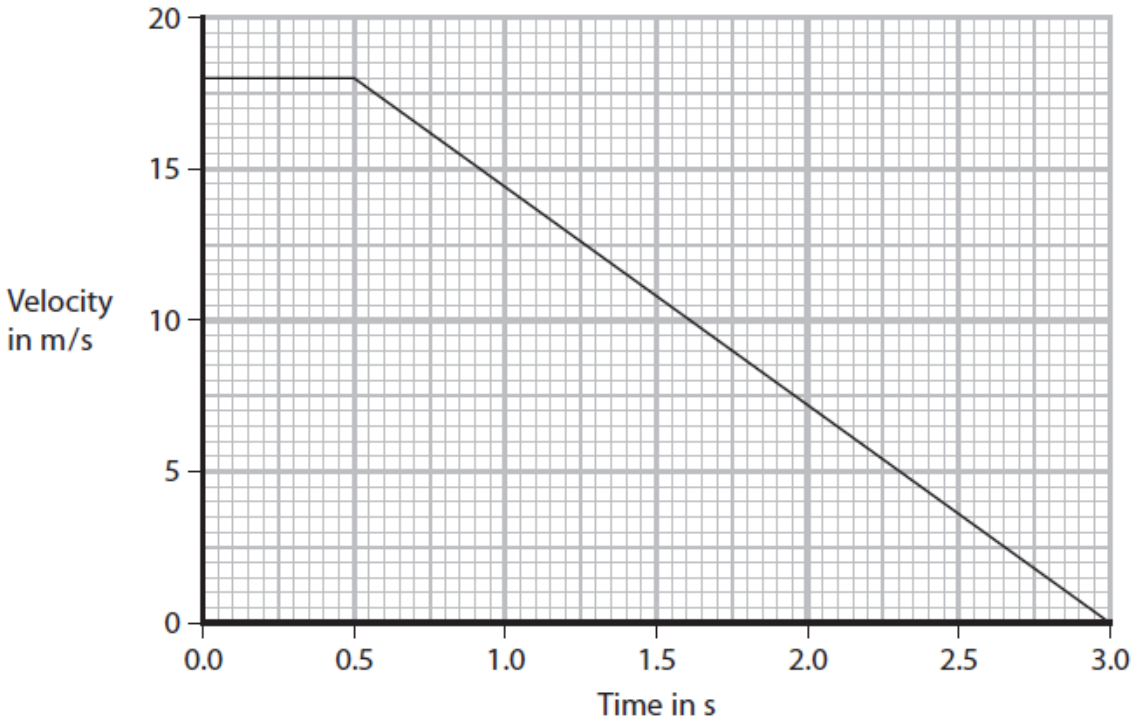
(2)

acceleration = ... m/s^2

(b) The driver sees an obstacle in the road and applies the brakes.

The driver has a reaction time of 0.5 s. He applies the brakes for 2.5 s.

The graph shows how the velocity of the car changes from when the driver sees the obstacle until the car stops.



(i) Describe how the thinking distance is affected by the condition of the car's brakes and the speed of the car.

(2)

condition of brakes .....

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speed of car .....

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(ii) Use the graph to calculate the braking distance.

(3)

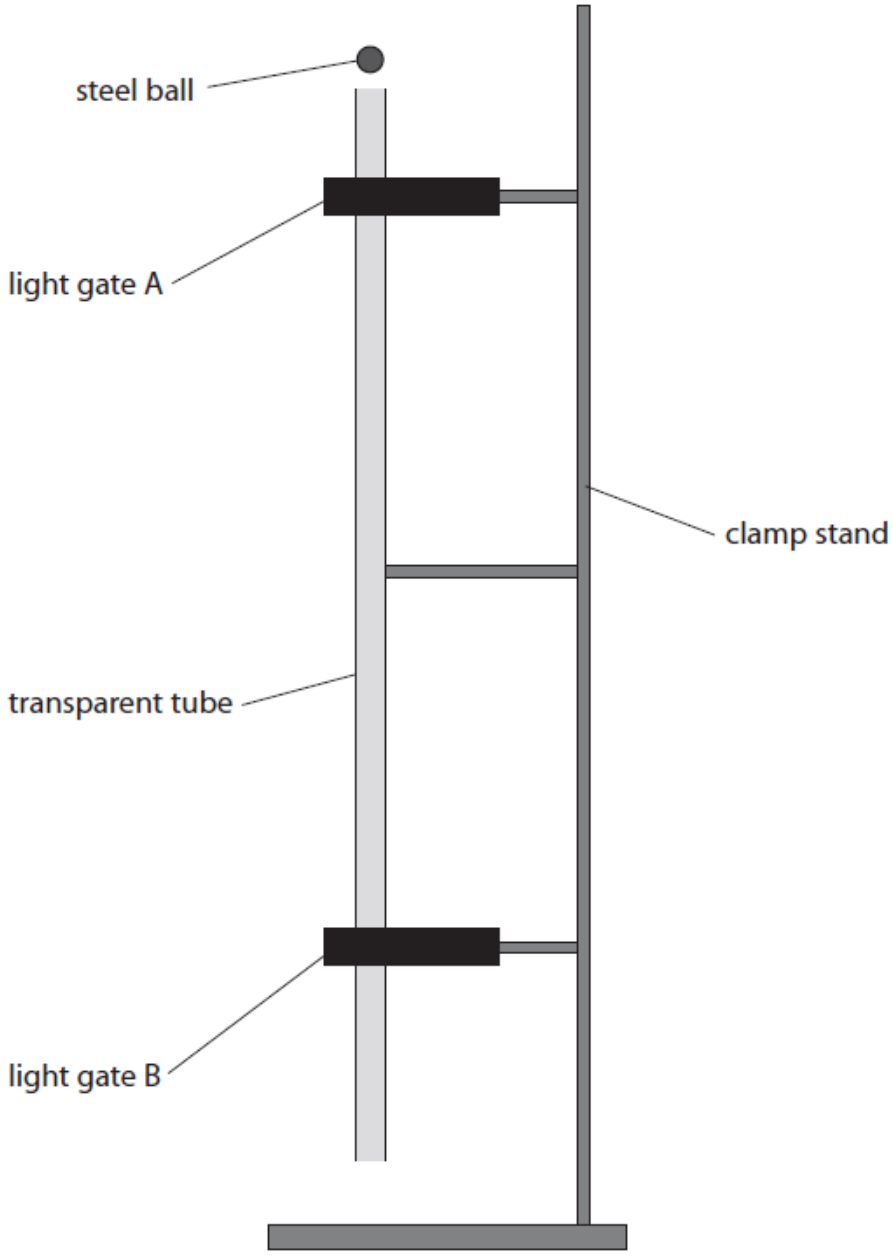
braking distance = ... m

(Total for question = 9 marks)

Q4.

A student does an experiment to determine the acceleration due to gravity, *g*.

The diagram shows the apparatus used.



This is the student's method.

- connect both light gates to a data logger
- drop a steel ball from rest at the top of the transparent tube
- record the speed of the ball at each light gate
- record the time taken for the ball to fall from light gate A to light gate B

(a) The box shows the data recorded by the data logger.

speed at A = 1.45 m/s

speed at B = 4.20 m/s

time from A to B = 0.286 s

(i) Show that the acceleration of the steel ball is approximately 9.6 m/s^2 .

(2)

acceleration = ... m / s^2

(ii) Explain why the student's value for the acceleration of the steel ball is lower than the accepted value for the acceleration due to gravity, *g*.

(2)

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(iii) Calculate the distance between the light gates.

(3)

distance = ... m

(b) The student changes the distance between the light gates by varying the position of light gate B.

The student measures the time taken for the steel ball to fall from light gate A to light gate B when the light gates are different distances apart.

The table shows the student's results.

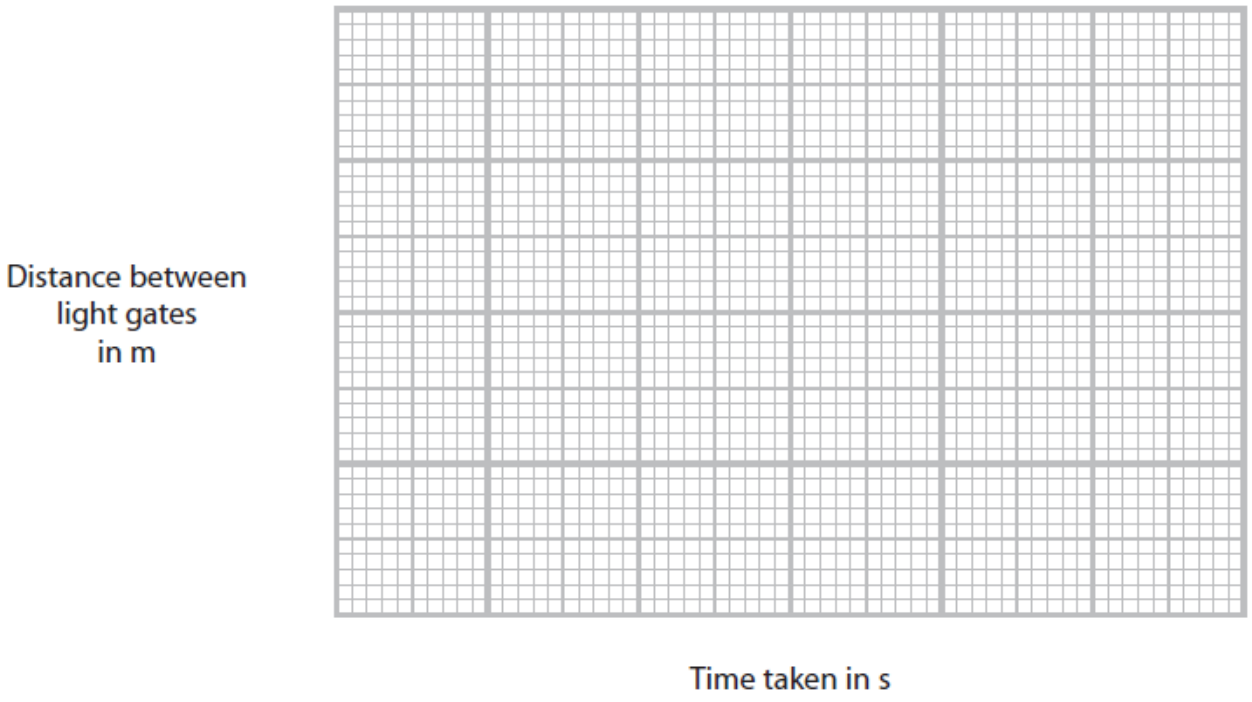
Distance between light gates in m	Time taken in s
0.10	0.058
0.20	0.103
0.30	0.141
0.40	0.175
0.50	0.205
0.60	0.233
0.70	0.260

(i) Plot a graph of the student's results on the grid.

(2)

(ii) Draw the curve of best fit.

(1)



(iii) Explain how the graph shows that the steel ball is accelerating as it falls.

(3)

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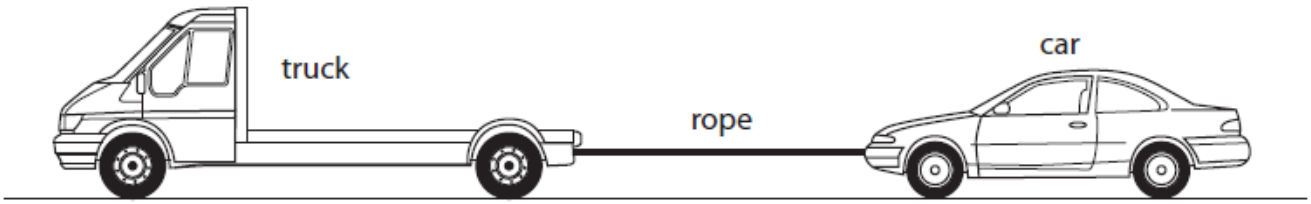
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(Total for question = 13 marks)

Q5.

The diagram shows a truck using a rope to pull a car along a level road.



(a) The truck and car are travelling at a velocity of 14 m / s.

The truck and car then accelerate at 1.6 m / s^2 until they are travelling at a velocity of 22 m / s.

(i) State the formula linking acceleration, change in velocity and time taken.

(1)

(ii) Calculate the time taken for the truck and car to accelerate from 14 m / s to 22 m / s.

(3)

time taken = ... s

(iii) State the formula linking unbalanced force, mass and acceleration.

(1)

(iv) The car has a mass of 1200 kg.

Calculate the unbalanced force acting on the car to produce an acceleration of 1.6 m / s^2 .

Give your answer to two significant figures.

(3)

unbalanced force = ... N

(b) The rope breaks so the car and the truck are no longer connected.

The engine of the car is not working.

Explain what happens to the motion of the car after the rope breaks.

(2)

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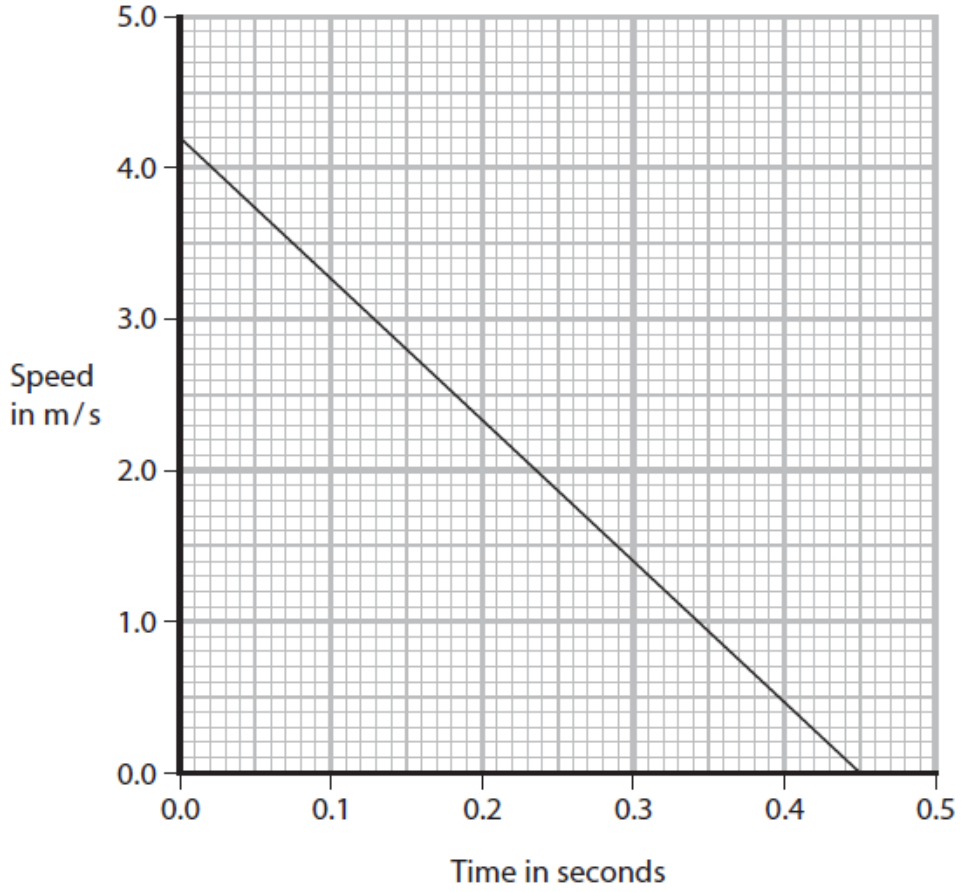
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(Total for question = 10 marks)

Q6.

(a) A person throws an object vertically upwards.

The speed-time graph shows how the speed of the object varies from the time it is thrown until reaching its maximum height.



(i) Calculate the acceleration of the object.

(3)

acceleration = ... m / s^2

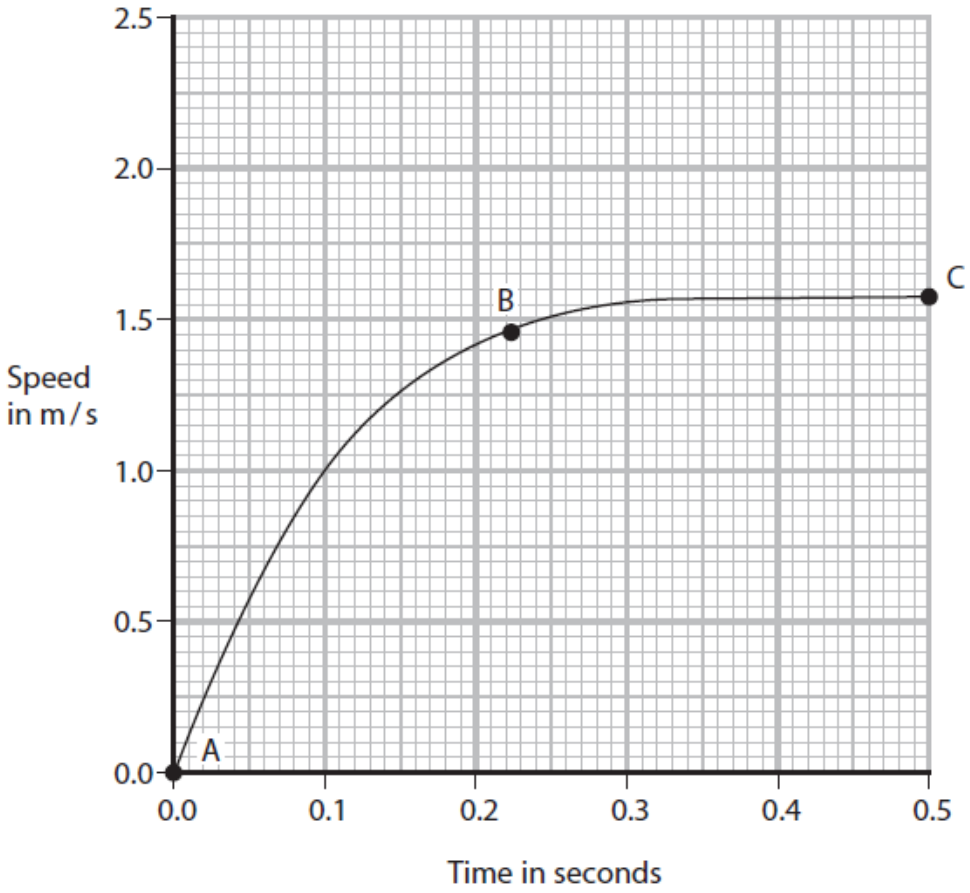
(ii) Calculate the distance the object travels to reach its maximum height.

(3)

distance = ... m

(b) A different object is dropped from rest and begins to fall.

The graph shows how the speed of this object varies with time.



(i) Give the name of the two forces acting on the object as it falls.

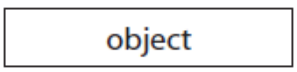
(2)

1 .....

2 .....

(ii) Draw arrows on the diagram to show the forces acting on the object at B.

(3)



(iii) Explain the shape of the graph from A to C.

You should use ideas about forces to help your answer.

(4)

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(Total for question = 15 marks)

Q7.

A driver of a car sees an obstruction in the road ahead and must stop the car.

(a) (i) State the formula linking average speed, distance travelled and time taken.

(1)

(ii) A car travels at 21 m / s.

The driver's reaction time is 0.14 seconds.

Calculate the distance travelled by the car during the driver's reaction time.

(2)

distance = ... m

(b) The car experiences a braking force of 7600 N.

The car has a mass of 1200 kg.

(i) State the formula linking force, mass and acceleration.

(1)

(ii) Calculate the acceleration of the car.

(2)

acceleration = ... m / s^2

(iii) Calculate the braking distance travelled as the speed of the car is reduced from 21 m/s to 0 m/s.

(3)

distance = ... m

(Total for question = 9 marks)

Q8.

(a) A speed camera is positioned at the side of a road.



© Darryl Sleath/Shutterstock

The camera measures the speed of a vehicle on the road to determine whether the vehicle is travelling too fast.

The camera takes two photographs of the vehicle 0.25 s apart.

The photographs are used to measure the distance travelled by the vehicle during this time.

(i) State the formula linking average speed, distance moved and time taken.

(1)

(ii) In the time between the two photographs, the car travels a distance of 6.5 m.

Calculate the average speed of the car.

(2)

average speed = ... m/s

(iii) The speed limit of the road is 80 kilometres per hour.

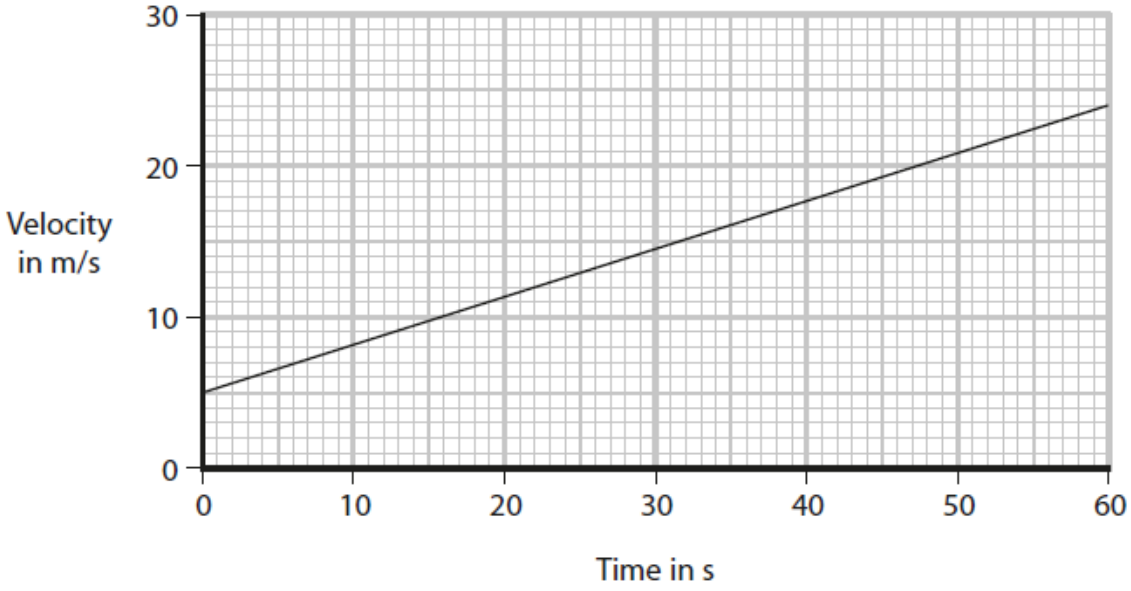
Determine whether the car is exceeding the speed limit.

(2)

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(b) The velocity-time graph shows how the velocity of a lorry changes with time.



(i) Explain how the graph shows that the lorry has a constant acceleration.

(2)

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(ii) State the formula linking acceleration, change in velocity and time taken.

(1)

(iii) Calculate the acceleration of the lorry.

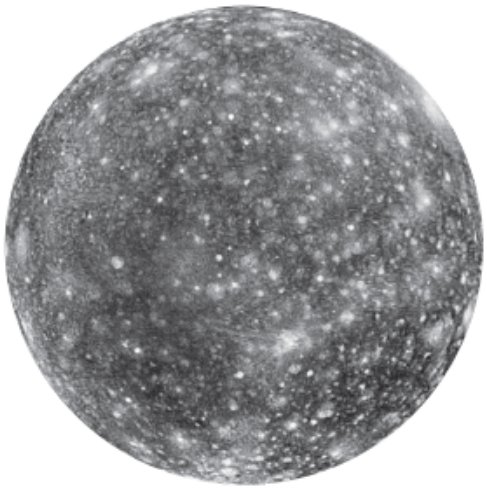
(3)

acceleration = ... m/s^2

(Total for question = 11 marks)

Q9.

The photograph shows Callisto, a moon of the planet Jupiter.



(Source: © Elena11/Shutterstock)

(a) In the space below, draw a labelled diagram to show how Callisto orbits Jupiter.

(2)

(b) Callisto orbits Jupiter at an orbital radius of 1 880 000 km and with an orbital period of 400 hours.

Calculate the orbital speed of Callisto in km/s.

Give your answer to 3 significant figures.

(4)

orbital speed = ... km/s

(c) Callisto has a gravitational field strength of 1.2 N/kg at its surface.

The Earth's moon has a gravitational field strength of 1.6 N/kg at its surface.

(i) Callisto has a larger mass than the Earth's moon.

Suggest why Callisto has a lower gravitational field strength than the Earth's moon.

(1)

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(ii) An object has a weight of 59 N on the surface of the Earth's moon.

Calculate the weight of the same object if it were on the surface of Callisto.

(3)

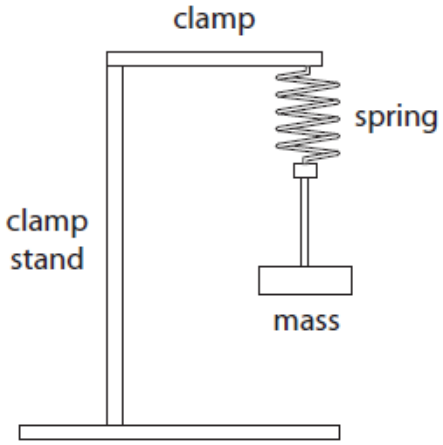
weight = ... N

(Total for question = 10 marks)

Q10.

A student investigates how the extension of a spring varies when the mass attached to the spring is changed.

(a) The diagram shows most of the equipment the student uses in the investigation.



Describe a method the student could use for the investigation.

Your description should include the measurements taken and how the student could obtain accurate results.

(5)

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(b) The student calculates the force each mass applies to the spring.

The table shows the student's results.

Force in N	Extension in cm
0.0	0.0
1.0	2.5
2.0	5.0
3.0	9.8
4.0	10.0
5.0	12.5
6.0	15.5
7.0	19.5

(i) Plot the student's results.

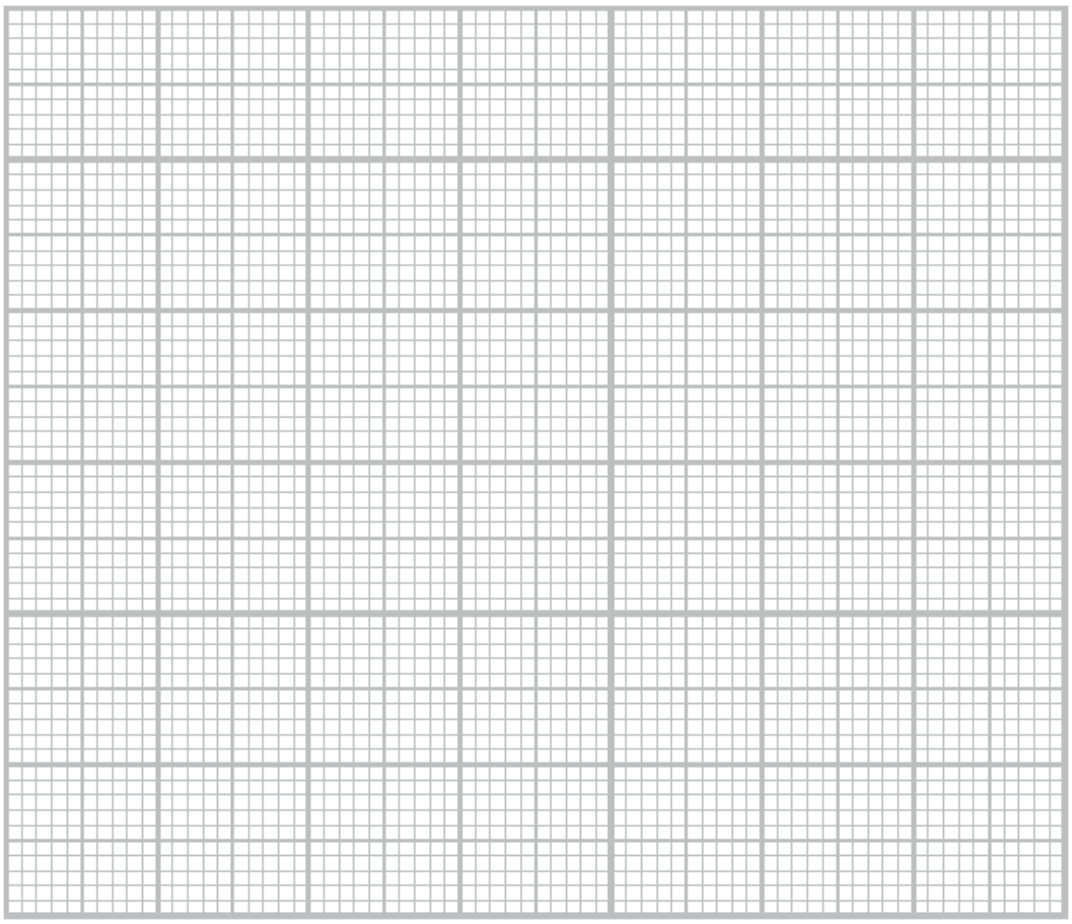
(3)

(ii) Draw a circle around the anomalous point.

(1)

(iii) Draw a line of best fit.

(1)



(iv) Explain whether the spring obeys Hooke's Law.

(3)

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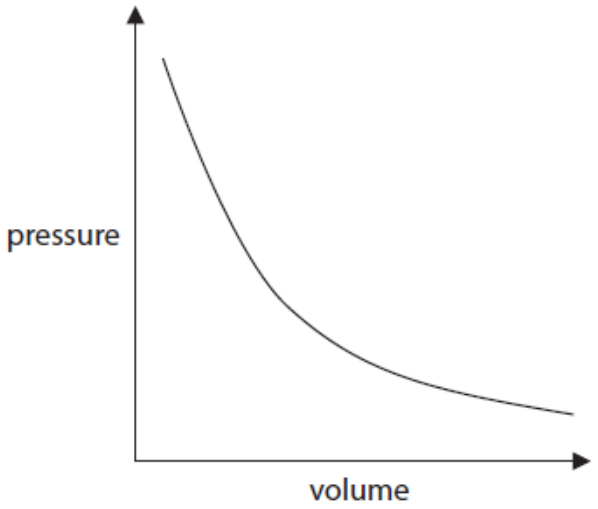
(Total for question = 13 marks)

Q11.

A glass contains fizzy water.

Bubbles of carbon dioxide form at the bottom of the glass and rise to the surface.

(a) The graph shows the relationship between the volume of a bubble and the pressure of the gas in the bubble.



(i) Describe the relationship shown by the graph.

(2)

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(ii) State the formula linking pressure difference, height, gravitational field strength and density.

(1)

(iii) The depth of the fizzy water in the glass is 22 cm.

The density of the fizzy water is 1080 kg/m^3.

Calculate the pressure difference at the bottom of the glass due to the fizzy water.

(2)

pressure difference = ... Pa

(iv) Calculate the pressure of the gas in the bubble when the bubble is at the bottom of the glass.

[atmospheric pressure = 101 000 Pa]

(1)

pressure = ... Pa

(v) When a bubble is at the top of the glass, the pressure of the gas in the bubble is equal to 101 000 Pa and the bubble has a volume of 0.084 cm^3.

Calculate the volume of the gas in the bubble when the bubble is at the bottom of the glass.

Assume the temperature of the gas remains constant.

(3)

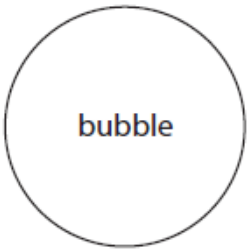
volume = ... cm^3

(b) A force called upthrust acts vertically upwards on the bubble.

When the bubble is released, it accelerates vertically upwards.

Draw two labelled arrows on the diagram to show the forces on the bubble as it is released.

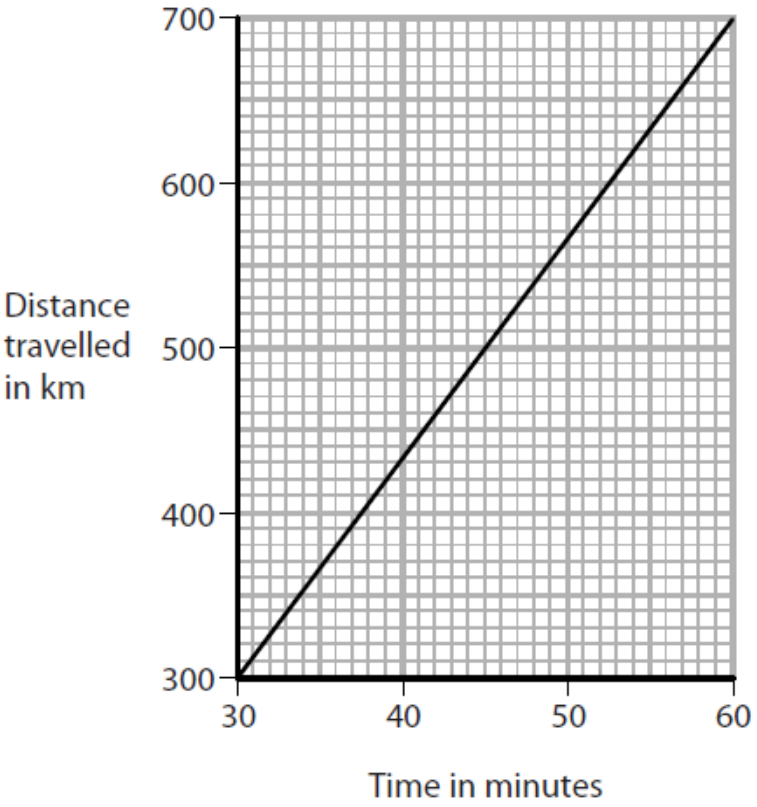
(3)



(Total for question = 12 marks)

Q12.

The graph shows how the distance travelled by an aeroplane changes during part of its journey.



(a) (i) State the formula linking average speed, distance moved and time taken.

(1)

(ii) Calculate the average speed of the aeroplane during this part of its journey.

Give a suitable unit.

(4)

average speed = ... unit .....

(b) During the flight, the height of the aeroplane decreases.

As the height of the aeroplane decreases, the temperature outside the aeroplane increases.

Explain how the air pressure outside the aeroplane changes as the height of the aeroplane decreases.

(3)

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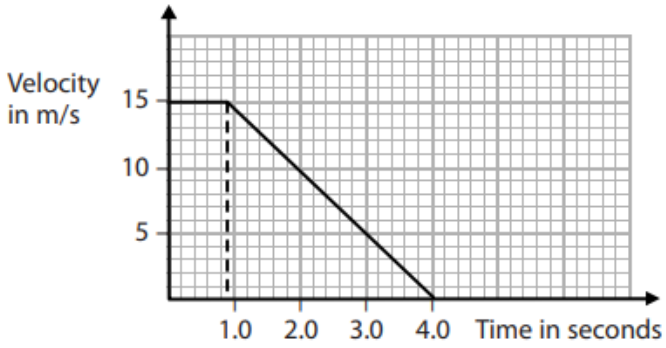
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(Total for question = 8 marks)

Q13.

A car driver sees a hazard on the road ahead.

The graph shows the velocity of the car from when the driver sees the hazard.



(a) (i) Use the graph to determine the reaction time of the driver.

(1)

reaction time = ... s

(ii) Calculate the stopping distance of the car.

(4)

stopping distance = ... m

(iii) Calculate the acceleration of the car when the car is braking.

(3)

acceleration = ... m/s^2

(b) The speed of the car affects the thinking distance and the braking distance.

Discuss other factors that affect the thinking distance and the braking distance of the car.

(4)

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(Total for question = 12 marks)

Q14.

Thrust SSC was the first land-based vehicle to travel faster than the speed of sound.



(a) Thrust SSC has a mass of 10 600 kg and uses two jet engines to produce a maximum accelerating force of 223 kN.

(i) State the formula linking unbalanced force, mass and acceleration.

(1)

(ii) Show that the maximum acceleration of Thrust SSC is approximately 20 m/s^2.

(3)

(b) The speed of sound in air is 330 m/s.

Calculate the minimum time taken for Thrust SSC to reach the speed of sound if it starts from rest.

(3)

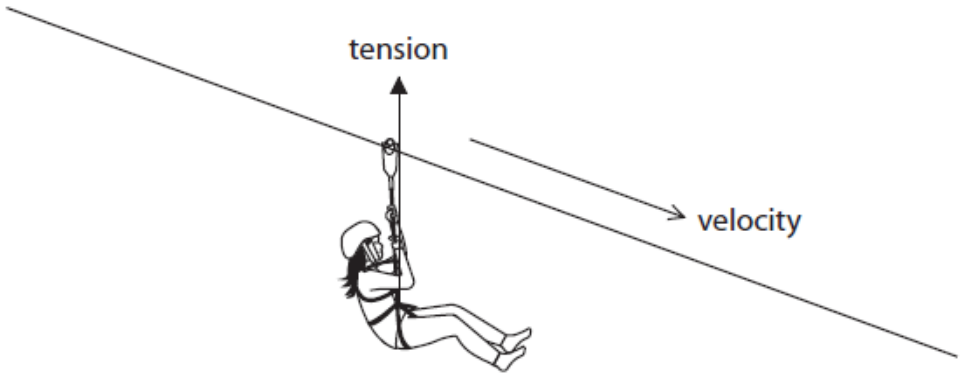
minimum time = ... s

(Total for question = 7 marks)

Q15.

The diagram shows a child on a zip-line ride.

During the ride the child slides along a metal wire with the velocity in the direction shown in the diagram.



The diagram also shows the tension force acting on the safety harness the child is wearing.

(a) Force and velocity are examples of vector quantities.

State what is meant by the term **vector quantity**.

(1)

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(b) Draw labelled arrows on the diagram to show two other forces that act on the child.

(4)

(Total for question = 5 marks)

Q16.

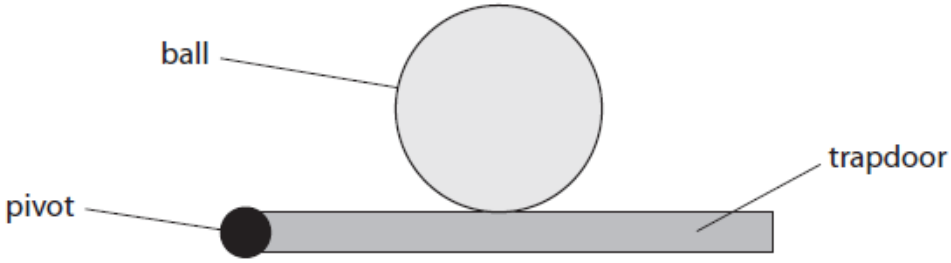
This question is about the motion of a ball.

(a) A ball is at rest on a trapdoor.

Complete the diagram to show the forces acting on the ball.

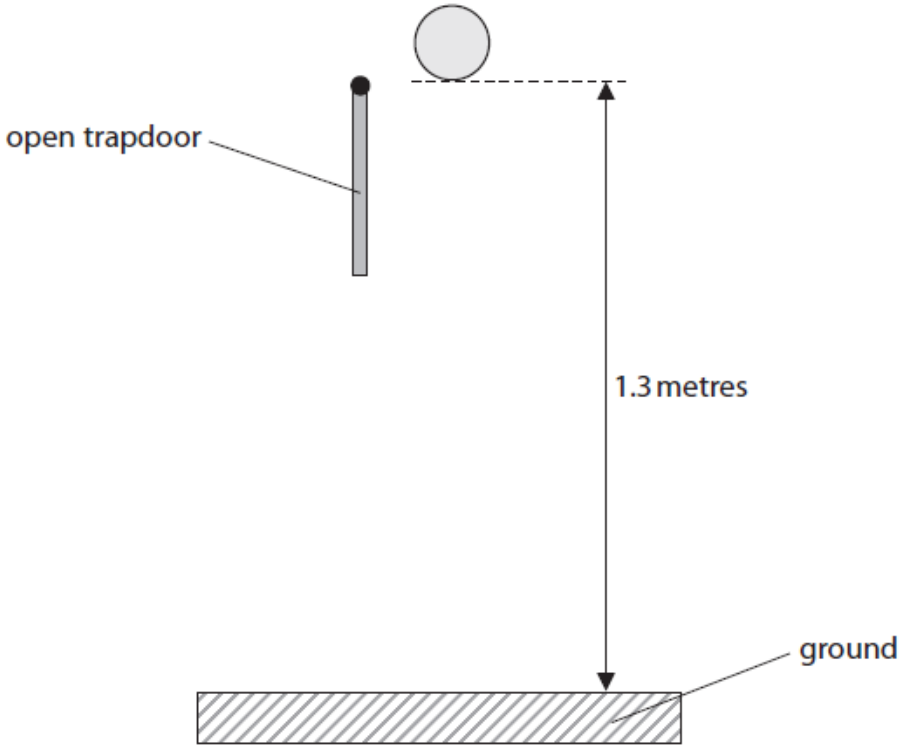
Label the forces.

(3)



(b) The trapdoor swings open and the ball falls to the ground.

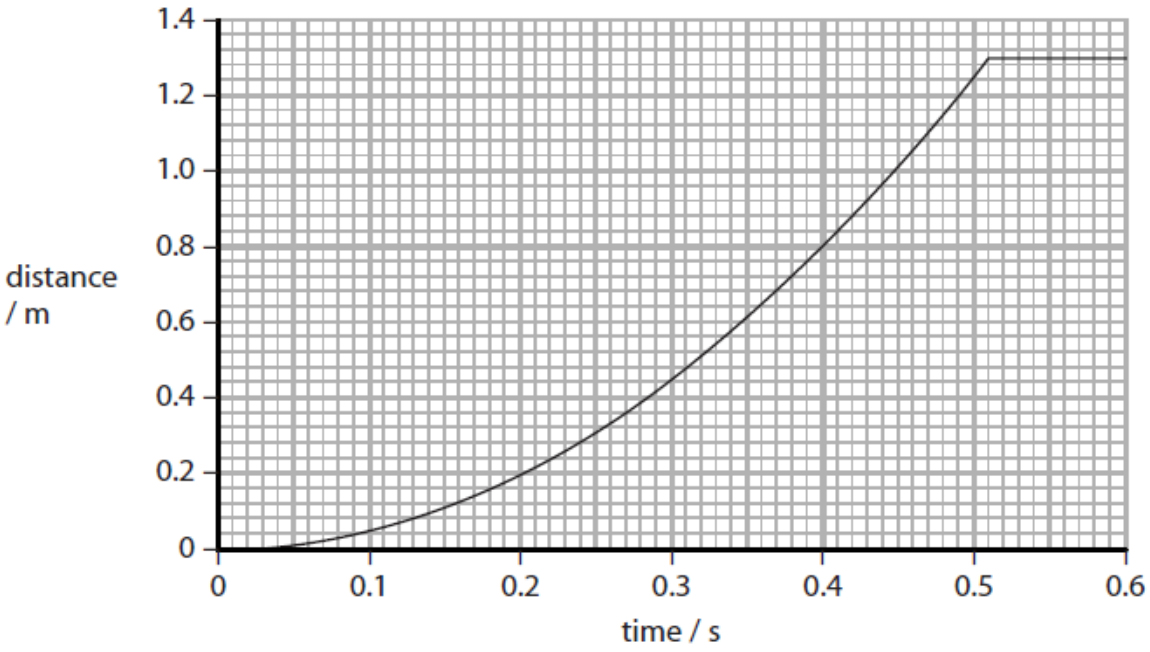
The ball does not bounce when it hits the ground.



Show that the final speed of the ball at the instant before it hits the ground is about 5 m/s.

(3)

(c) The graph shows how the distance travelled by the ball changes with time.



(i) Determine the time taken for the ball to hit the ground.

(1)

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(ii) State the equation relating average speed, distance moved and time taken.

(1)

(iii) Calculate the average speed of the ball after 0.40 s.

(1)

average speed = ... m/s

(iv) Explain how the graph shows that the ball accelerates when it falls.

(3)

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(Total for question = 12 marks)

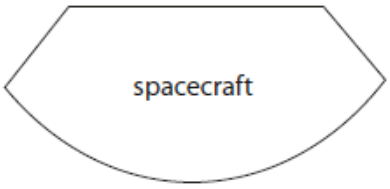
Q17.

Schiaparelli is a spacecraft that was sent to Mars in 2016.

(a) Schiaparelli slowed down as it fell vertically through the atmosphere of Mars.

(i) Draw labelled arrows on the diagram to show the forces acting on Schiaparelli as it fell.

(3)



(ii) Schiaparelli then opened a parachute to slow down.

Explain how the spacecraft reached a low terminal velocity after opening its parachute.

Use ideas about forces in your answer.

(4)

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(b) The parachute was disconnected when Schiaparelli was at a height of 2.0 m from the surface of Mars and travelling at a speed of 0.45 m/s.

Calculate the speed of the spacecraft just before it hits the surface of Mars.
[acceleration of free-fall on Mars = 3.4 m/s^2]

(4)

speed = ... m/s

(c) Suggest why Mars has a lower gravitational field strength than Earth.

(1)

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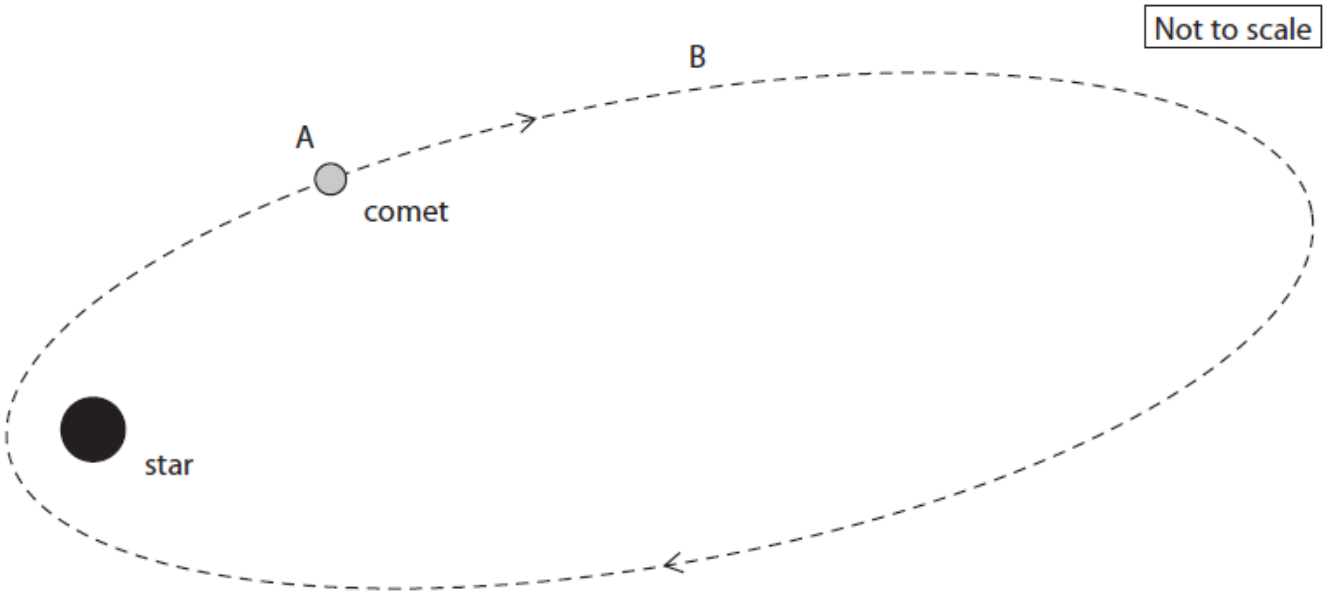
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(Total for question = 12 marks)

Q18.

A comet orbits a star because of the gravitational force between the comet and the star.



(a) Draw an arrow on the diagram to show the gravitational force acting on the comet due to the star.

(1)

(b) Weight is another term used for gravitational force.

At point A on the diagram the comet has a weight of 4.4×10^{9} N.

The comet has a mass of 2.2×10^{14} kg.

Calculate the gravitational field strength at point A.

Give a suitable unit for your answer.

(4)

gravitational field strength = ... , unit = ...

(c) The comet moves from point A to point B during its clockwise orbit around the star.

Explain what happens to the gravitational force acting on the comet due to the star as the comet moves from point A to point B.

(3)

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(Total for question = 8 marks)

Q19.

(a) (i) State Hooke's Law.

(2)

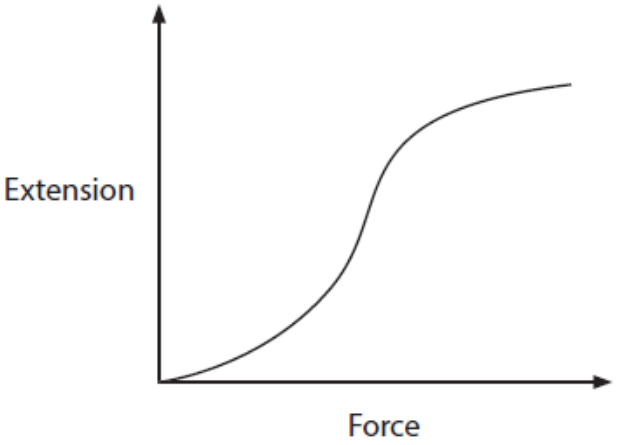
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(ii) The graph shows how the extension of a rubber band varies with the force applied.



Explain how the graph shows that the rubber band does not obey Hooke's Law.

(2)

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(b) Diagram 1 shows a model aeroplane powered by a rubber band.

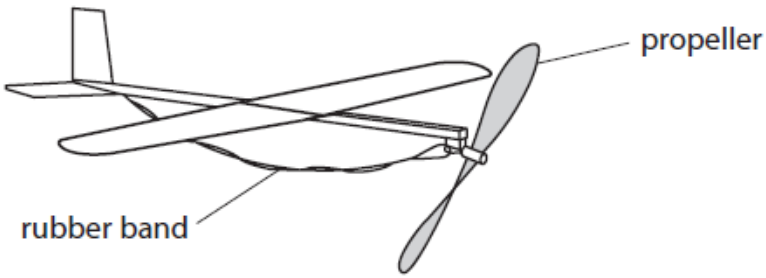


Diagram 1

A person rotates the propeller of the model aeroplane, which twists the rubber band.

He then releases the propeller and it spins.

Energy transfer occurs during this process.

The box lists words associated with energy.

kinetic	gravitational	electrostatic
mechanical	elastic	magnetic
heating	chemical	radiation

Use words from the box to complete the passage.

(3)

The person does ..... work to twist the rubber band.

As the person twists the rubber band it extends, increasing the .....

energy store of the rubber band. When the rubber band is released it does mechanical work,

increasing the ..... energy store of the propeller.

(c) Diagram 2 shows the aeroplane flying horizontally to the right.

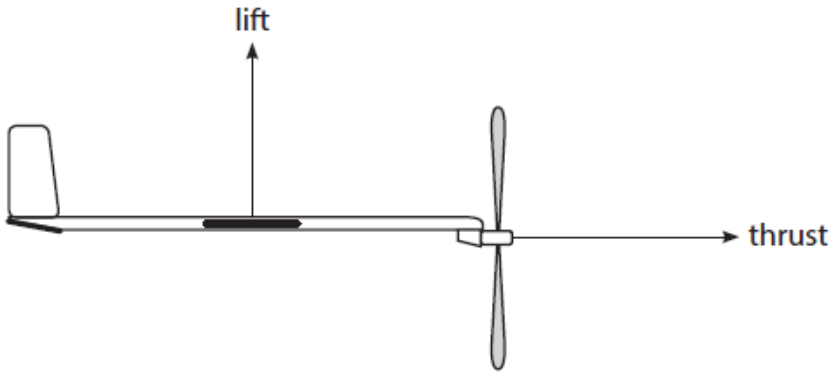


Diagram 2

The aeroplane flies at a constant speed.

Diagram 2 shows two forces acting on the aeroplane.

Draw labelled arrows on diagram 2 to show two more forces acting on the aeroplane.

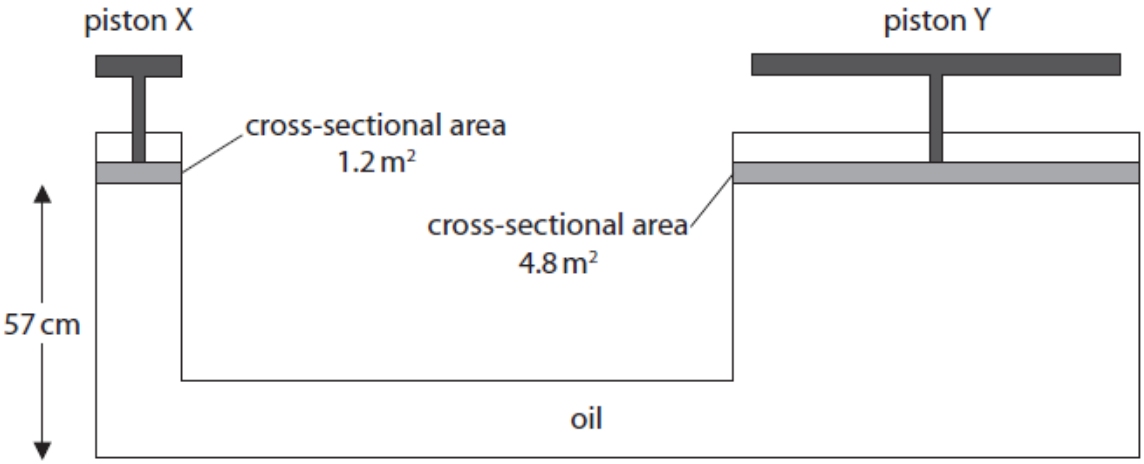
(4)

(Total for question = 11 marks)

Q20.

The diagram shows a device called a hydraulic lift.

The hydraulic lift consists of a tube of oil with a piston at each end.



(a) Calculate the pressure difference between the bottom of piston X and the bottom of the oil.

[density of oil = 820 kg/m^3]

(3)

pressure difference = ... Pa

(b) A 24 kg mass is placed on piston X.

(i) Calculate the weight of the 24 kg mass.

Give the unit.

(3)

weight =..... unit.....

(ii) Calculate the extra pressure on the oil due to the mass.

(2)

extra pressure = ... Pa

(iii) The oil transfers the same extra pressure to piston Y.

Calculate the force acting upwards on piston Y due to the extra pressure.

(3)

force = ... N

(c) Piston Y starts at rest, rises slowly and then comes to rest.

State how the following energy stores have changed from before the motion to after the motion is complete.

(4)

Energy store	Change
gravitational potential energy of piston X	
gravitational potential energy of piston Y	
chemical energy of piston Y	
kinetic energy of piston Y	

(Total for question = 15 marks)

Q21.

When a rubber ball is dropped it hits the floor and bounces.

Design an investigation to determine how the temperature of the rubber ball affects the maximum height the ball reaches after it bounces.

In your answer, refer to

- how to change the temperature of the ball
- the variables that need to be controlled
- how to obtain high-quality data

You may draw a labelled diagram to support your answer.

(6)

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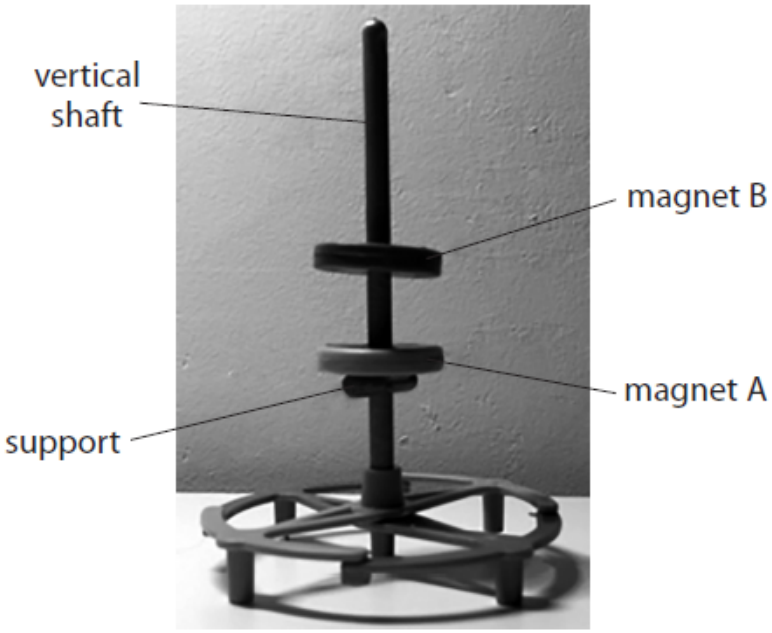
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(Total for question = 6 marks)

Q22.

Photograph 1 shows a child's toy.

The toy has two magnets on a vertical shaft.



Photograph 1

(a) Magnet A rests on a support near the bottom of the vertical shaft.

A student places magnet B at the top of the vertical shaft and releases it from rest.

Magnet B is repelled by magnet A causing it to come to rest again at the position shown.

The table shows some energy stores in magnet B.

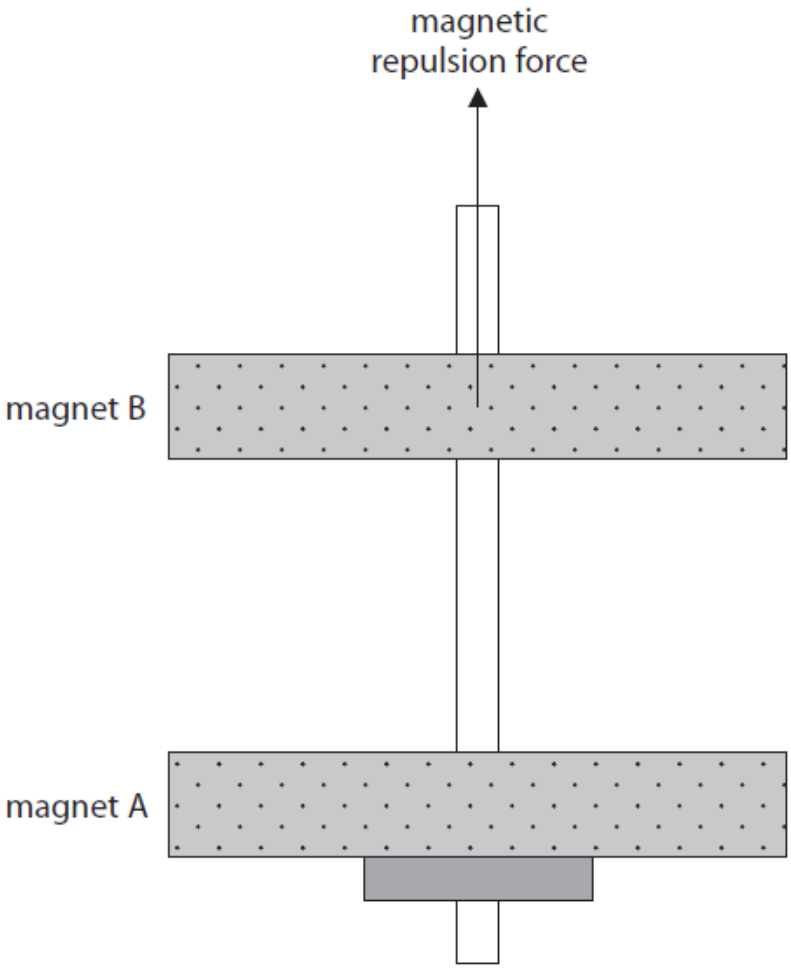
Put ticks (✓) in the correct boxes to show whether the amount of energy in each store of magnet B increases, decreases or stays the same when compared to its

value at the top of the vertical shaft.

(3)

Energy store in magnet B	Increases	Decreases	Stays the same
gravitational			
magnetic			
kinetic			

(b) This is a diagram of the toy shown in photograph 1.



One of the forces acting on magnet B is shown.

Draw another labelled arrow on the diagram to show the other force acting on magnet B.

(2)

(c) The student adds a 10 g mass on top of magnet B when it is stationary above

magnet A and observes that the distance between the magnets decreases.

He carries out an investigation to see how the distance changes as more masses are added.

In your answer, you should refer to

- the measuring equipment required
- the independent and dependent variables
- a way to check the reliability of the data

You may draw a diagram to help your answer.

(5)

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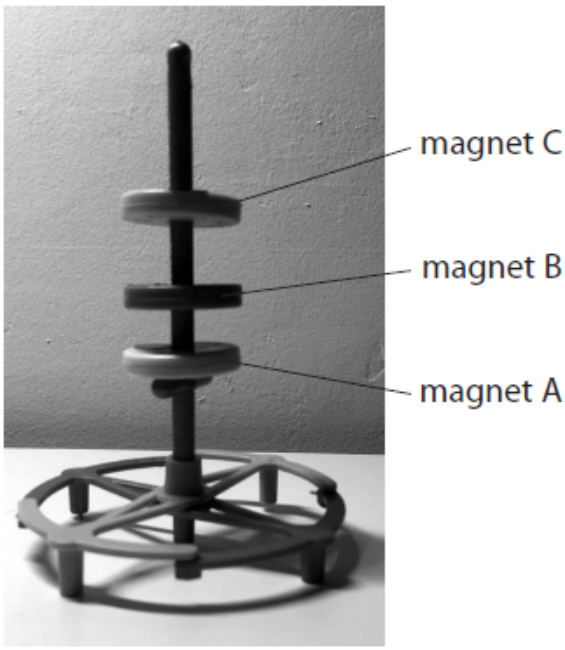
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(d) The student removes the masses from magnet B.

He then adds magnet C on to the vertical shaft.



Photograph 2

Photograph 2 shows that when magnet C is added, magnet B moves further down the shaft until it is at rest again.

Explain why the distance between magnet A and magnet B has decreased.

(3)

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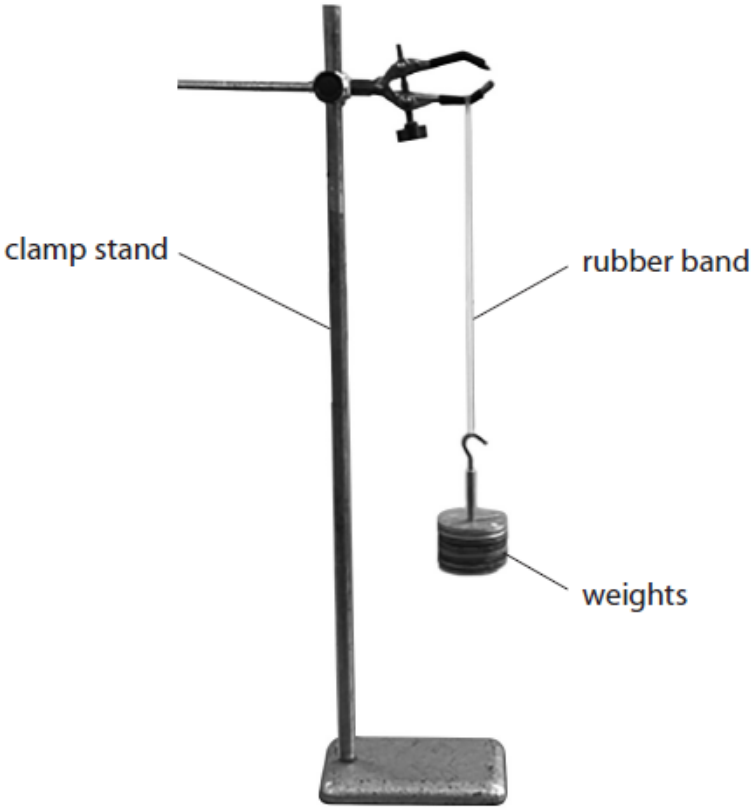
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(Total for question = 13 marks)

Q23.

A student uses this apparatus to investigate the stretching of a rubber band.



This is the student's method.

- attach the 12 cm long rubber band to a clamp stand
- hang a 1 N weight from the other end of the rubber band
- determine the extension of the rubber band

The student repeats this method, increasing the weight by 1 N each time until the weight is 10 N.

(a) Describe how the student could determine the extension of the rubber band.

(3)

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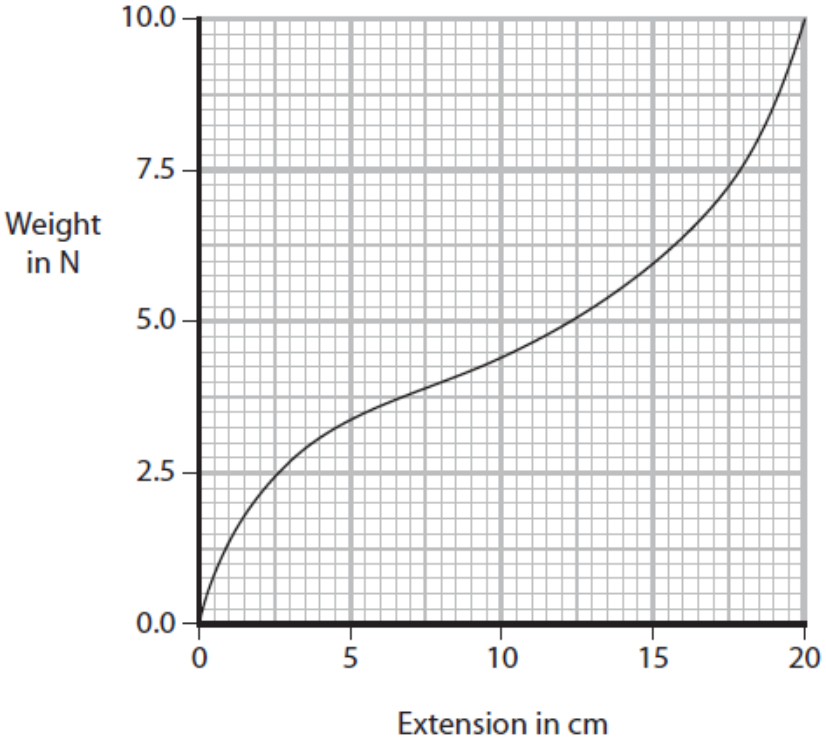
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(b) The graph shows the student's results.



(i) Explain how the graph shows that the rubber band does not obey Hooke's Law.

(2)

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(ii) The area under the curve on the graph is equal to the increase in the rubber band's elastic energy store.

Estimate the increase in the rubber band's elastic energy store when the rubber band has been extended by 20 cm.

(4)

increase = ... J

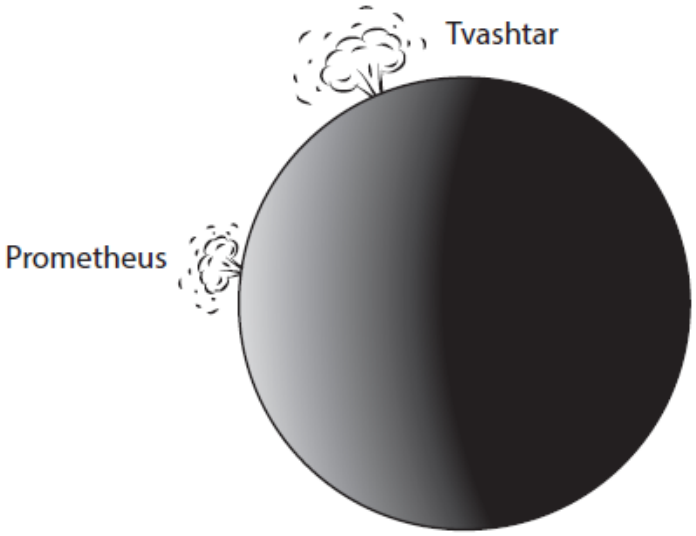
(Total for question = 9 marks)

Q24.

This is a question about Io, a moon of Jupiter.

The diagram shows two jets of gas from volcanoes on Io.

One jet of gas is from the volcano Prometheus and the other is from the volcano Tvashtar.



(a) Gas particles in the Prometheus jet leave the surface of Io and move vertically upwards.

The particles reach their maximum height when their speed is zero.

Some particles in the Prometheus jet reach a maximum height of 92 km.

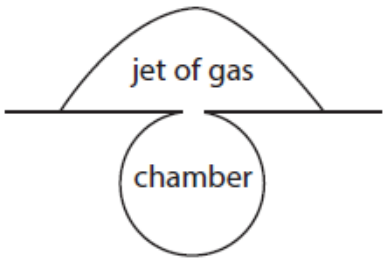
Calculate the initial speed of these particles as they leave the surface of Io.

[acceleration due to gravity on Io = 1.8 m/s^2]

(3)

initial speed = ... m/s

(b) Before the gas particles leave the surface of Io, they are trapped in a chamber.



(i) Explain how the gas particles exert a pressure on the walls of the chamber.

(3)

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(ii) The Tvashtar chamber has the same volume as the Prometheus chamber and contains the same number of molecules of the same type of gas.

The temperature of the gas in the Prometheus chamber is 1200 K.

The temperature of the gas in the Tvashtar chamber is 1600 K.

The pressure of the gas in the Prometheus chamber is 8.2 kPa.

Calculate the pressure of the gas in the Tvashtar chamber.

(3)

pressure = ... kPa

(iii) Explain why the pressure inside the chambers increases when the temperature increases.

Use ideas about particles in your answer.

(3)

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(iv) Explain why the particles from the Tvashtar chamber reach a greater maximum height than the particles from the Prometheus chamber.

(3)

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(Total for question = 15 marks)

Q25.

A student investigates how much pressure she exerts on the ground when she is standing up.

(a) The weight of the student is 520 N.

(i) State the formula linking weight, mass and gravitational field strength (g).

(1)

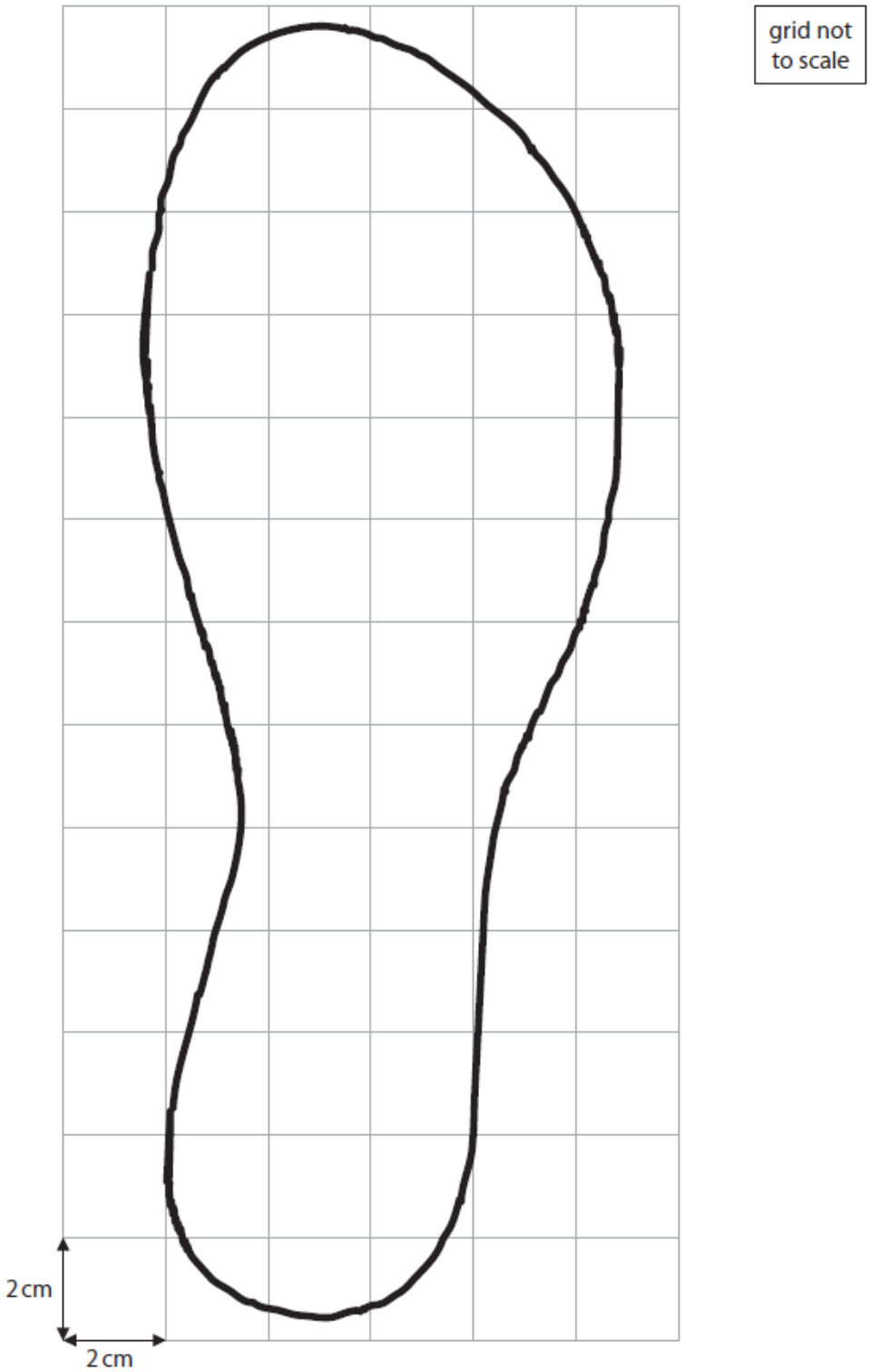
(ii) Calculate the mass of the student.

(2)

mass = ... kg

(b) The student measures the area of one of her feet when it is in contact with the ground.

She draws around her foot on a piece of squared paper.



(i) The squares on the paper have a side length of 2 cm.

Estimate the area of the student's foot in contact with the ground.

(4)

area = ... cm^2

(ii) State the formula linking pressure, force and area.

(1)

(iii) The weight of the student is 520 N.

Calculate the pressure the student exerts on the ground when she is standing on **both** feet.

Give the unit.

(3)

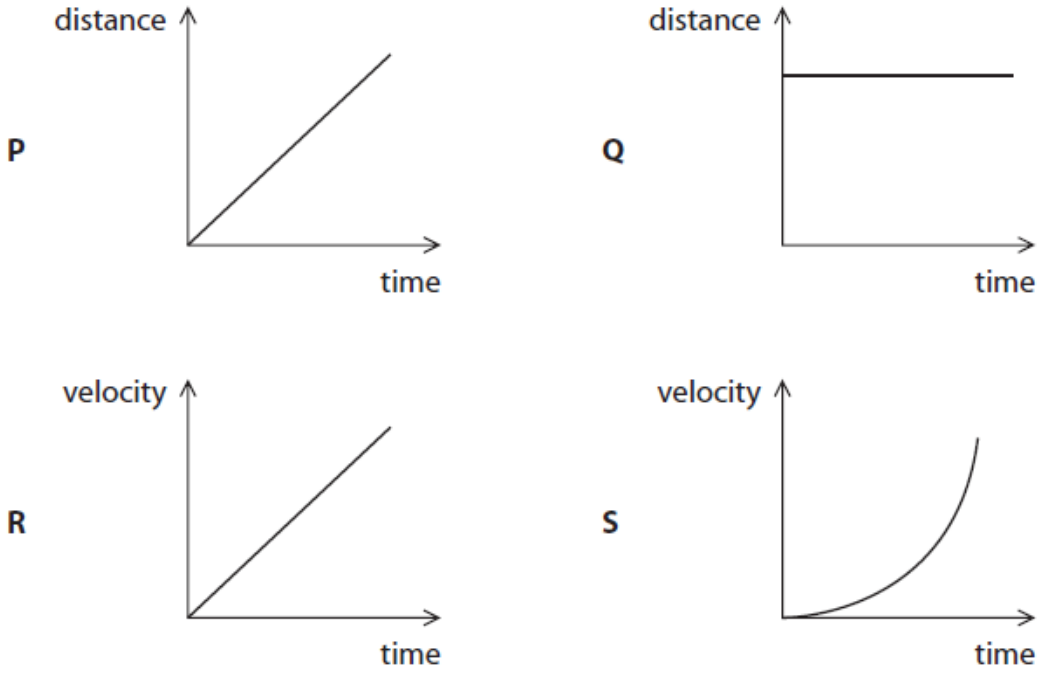
pressure = ... unit .....

(Total for question = 11 marks)

Q26.

The motion of an object can be represented using graphs.

(a) The graphs, P, Q, R and S, show different types of motion.



The table lists some types of motion.

Place one tick (✓) in each row of the table to show which graph represents which type of motion.

(4)

Type of motion	Graph			
	P	Q	R	S
constant acceleration				
increasing acceleration				
moving at constant velocity				
stationary				

(b) State the feature of a velocity-time graph that can be used to determine the distance travelled by an object.

(1)

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(Total for question = 5 marks)

Q27.

Very strong magnets can be made using the element neodymium.

(a) Diagram 1 shows parts of two neodymium magnets, X and Y, when they are held close together.

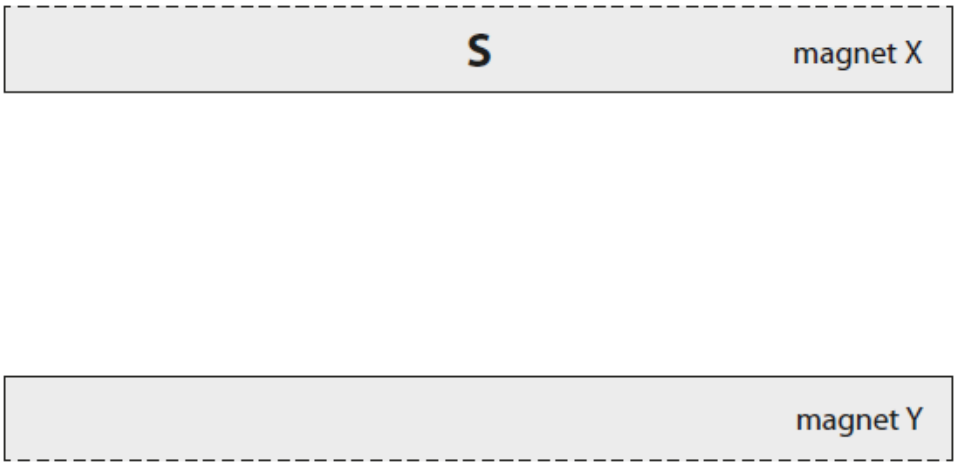


Diagram 1

A uniform magnetic field is produced in the space between the magnets.

Diagram 1 shows the south pole of magnet X.

Complete diagram 1 by drawing the uniform magnetic field and labelling the pole on magnet Y.

(3)

(b) Diagram 2 shows another neodymium magnet being used to lift an iron ball from a table.

The iron ball is shown at the instant it leaves the surface of the table.

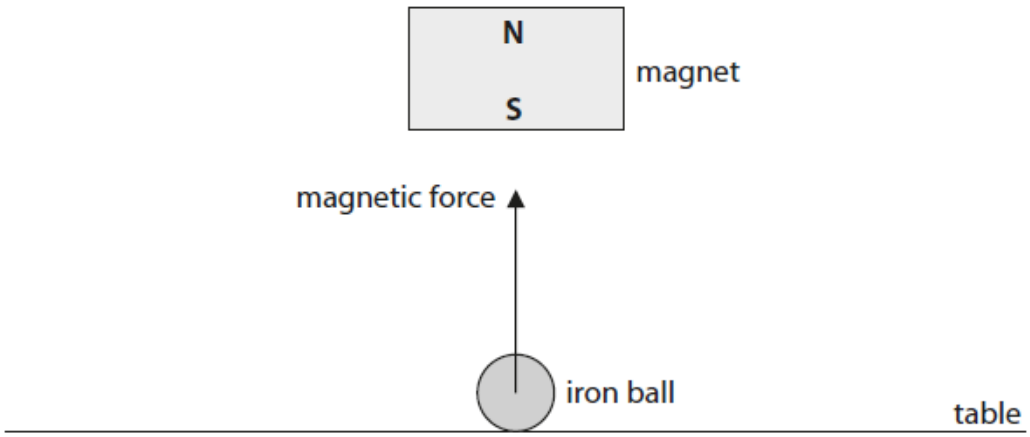


Diagram 2

(i) Explain why the iron ball experiences an upward magnetic force.

(2)

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(ii) The iron ball experiences an upward resultant force at the instant shown in diagram 2.

Draw a labelled arrow on diagram 2 to show the weight of the iron ball.

(1)

(iii) State the formula linking weight, mass and gravitational field strength.

(1)

(iv) At the instant shown in diagram 2, the resultant force acting on the iron ball is 124 mN and the magnetic force is 165 mN.

Calculate the mass of the iron ball.

(4)

mass of iron ball = ... kg

(v) Explain why the resultant force acting on the iron ball increases as the iron ball moves towards the magnet.

(2)

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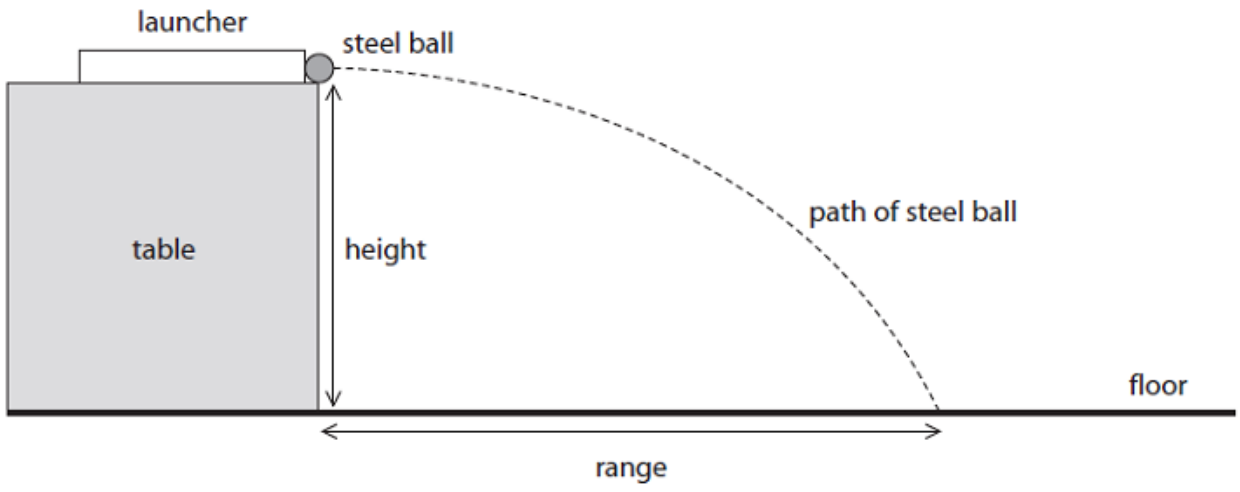
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(Total for question = 13 marks)

Q28.

A steel ball is fired from a launcher on an adjustable table.

A student investigates how the range of the steel ball varies with the height of the table.



(a) Describe a method for the student's investigation.

Your answer should include details of

- the variables in the investigation
- how the investigation will be valid (a fair test)
- how the range will be measured accurately

(6)

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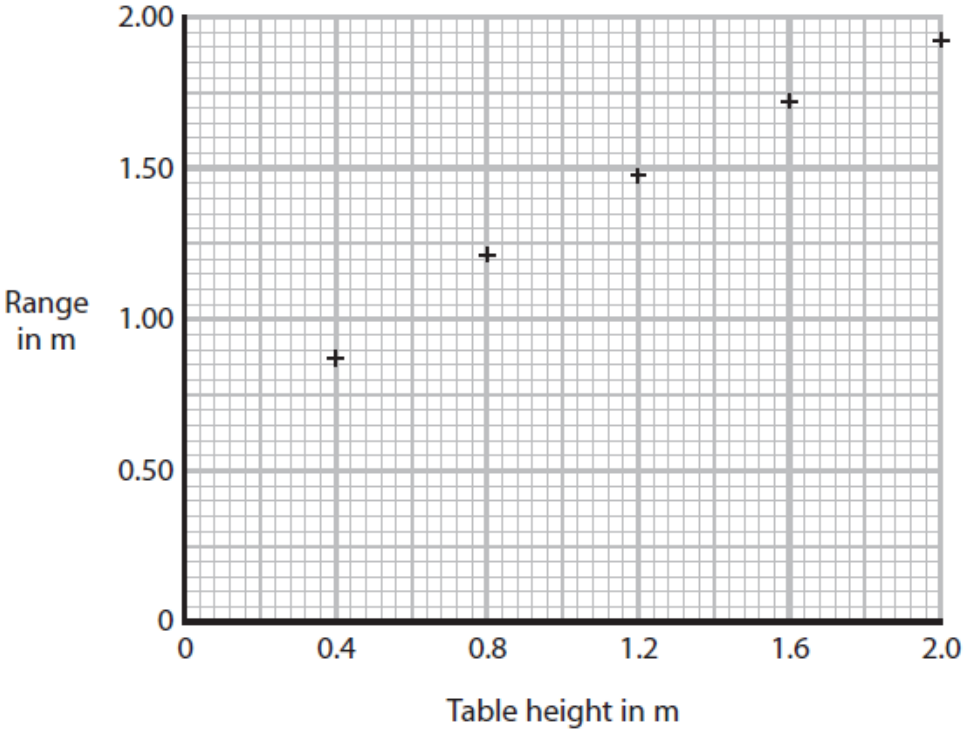
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(b) The graph shows the student's results.



(i) Draw the curve of best fit.

(1)

(ii) Estimate what the height of the table would be when the range of the projectile is 0.60 m.

(1)

height = ... m

(iii) Justify why the student has plotted a line graph rather than a bar chart.

(1)

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(iv) The range of the projectile is related to the table height by this formula

$$\text{range} = \text{launch speed} \times \sqrt{\frac{\text{table height}}{5}}$$

Using data from the graph, show that the launch speed of the projectile is approximately 3 m / s.

(4)

launch speed = ... m / s

(Total for question = 13 marks)

Q29.

Diagram 1 shows an ice cube floating at rest in a beaker of water.

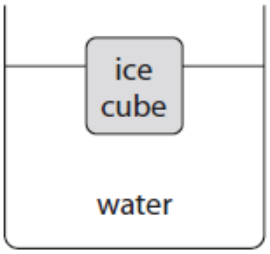


Diagram 1

(a) State the value of the resultant force on the ice cube.

(1)

resultant force = ... N

(b) Diagram 2 shows the ice cube pushed down into the water by force X.

The ice cube is at rest in this new position.

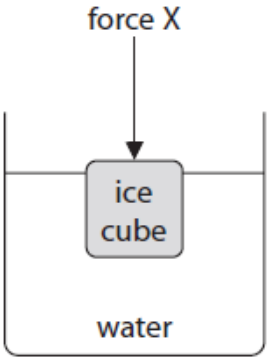


Diagram 2

(i) State the formula linking pressure difference, height, density and gravitational field strength.

(1)

(ii) The bottom of the ice cube is 0.041 m below the surface of the water.

The density of water is 1000 kg/m^3.

Show that the pressure difference between the bottom of the ice cube and the surface of the water is about 400 Pa.

(2)

(iii) State the formula linking pressure, force and area.

(1)

(iv) The area of the base of the ice cube is 0.0017 m^2.

Calculate the upward force on the bottom of the cube from the water due to the pressure difference.

(2)

upward force = ... N

(v) Explain why the ice cube will accelerate upwards when force X is removed.

(2)

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(Total for question = 9 marks)

Q30.

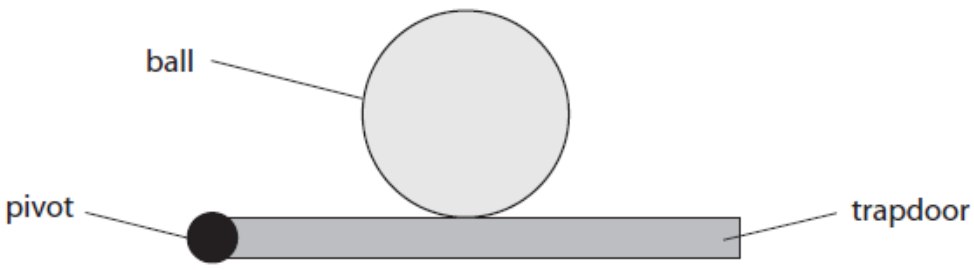
This question is about the motion of a ball.

(a) A ball is at rest on a trapdoor.

Complete the diagram to show the forces acting on the ball.

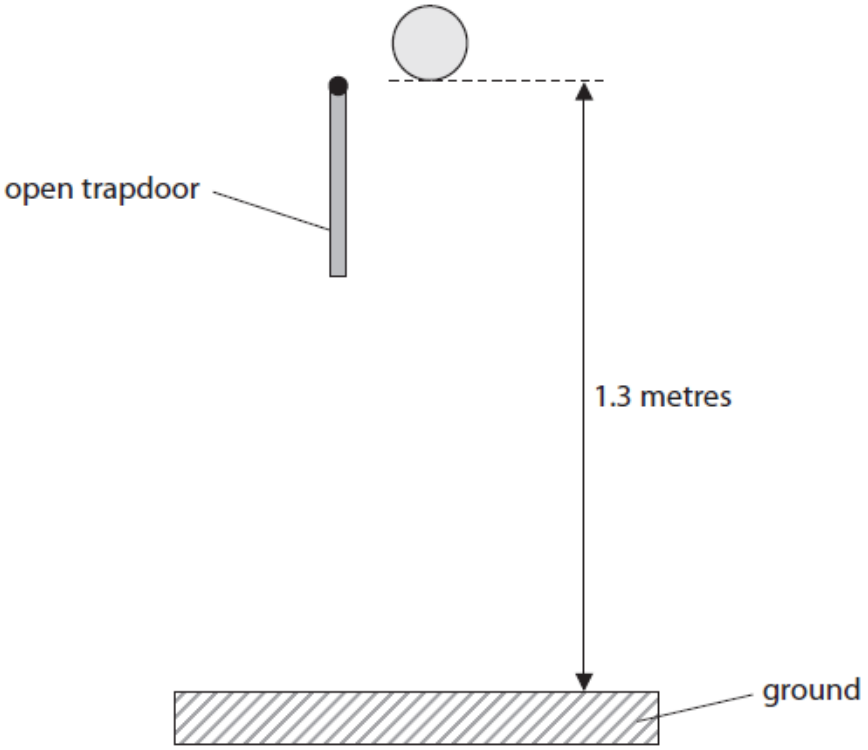
Label the forces.

(3)

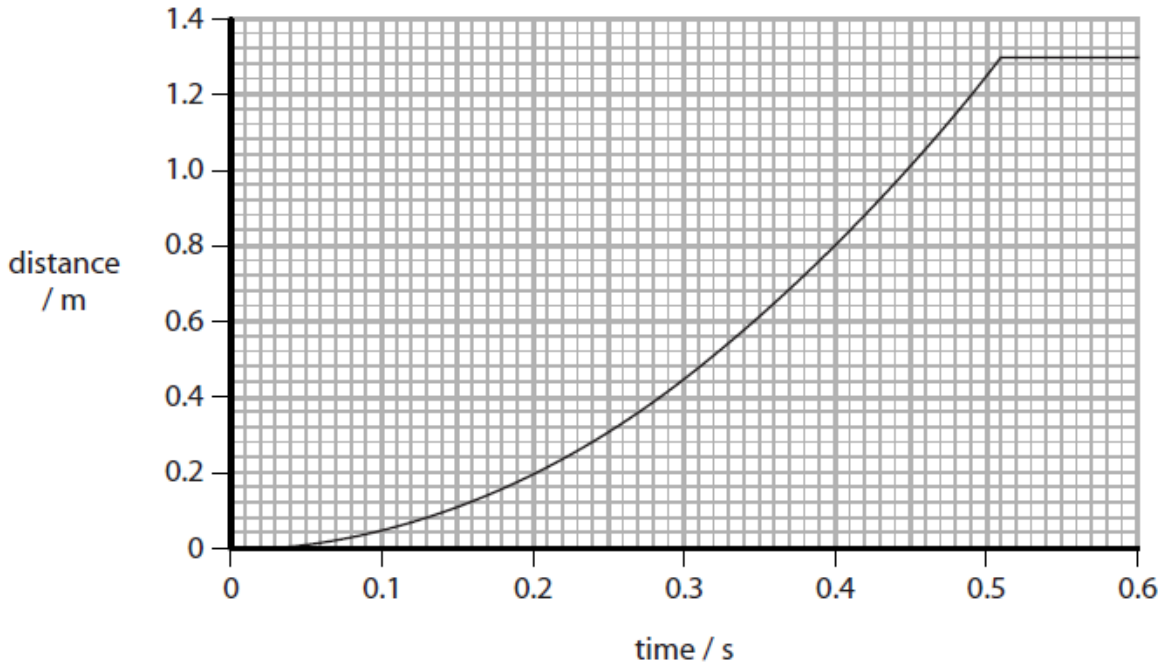


(b) The trapdoor swings open and the ball falls to the ground.

The ball does not bounce when it hits the ground.



The graph shows how the distance travelled by the ball changes with time.



(i) Determine the time taken for the ball to hit the ground.

(1)

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(ii) Explain how the graph shows that the ball accelerates when it falls.

(3)

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(Total for question = 7 marks)