PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 15: FORCES AND MATTER

SCORE	PERCENTAGE
/143	%

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Q1.

Figure 14 shows a spring standing on a table.

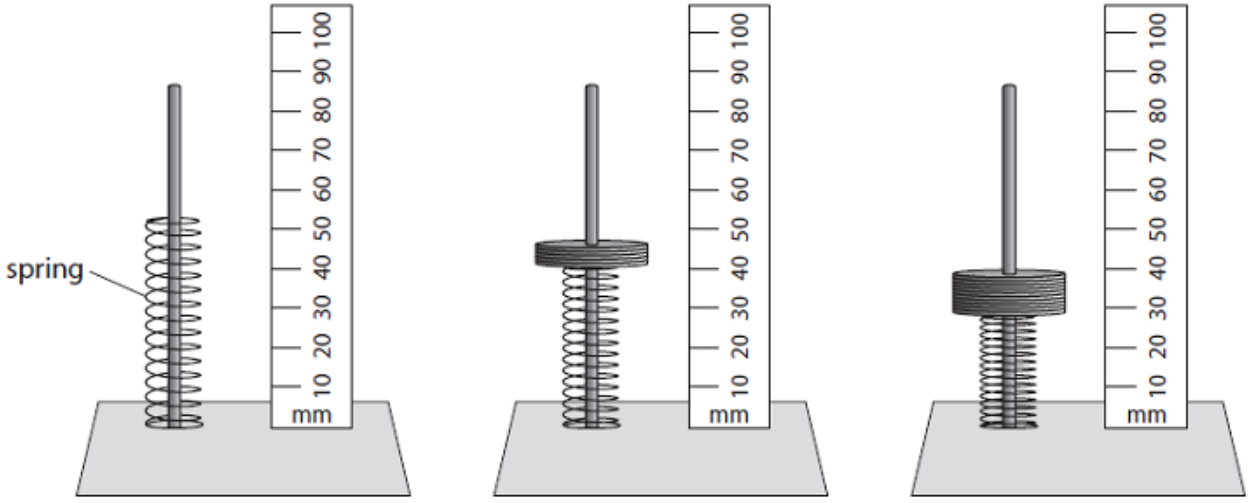


Figure 14a **Figure 14b** **Figure 14c**

Weights are added to the spring as shown in Figures 14b and 14c.

(i) Estimate the original length of the spring as shown in Figure 14a.

(1)

original length = ... mm

(ii) Describe how the reduction in the length of the spring when weights are added can be determined.

(2)

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(iii) State **two** ways that the experimental procedure could be improved.

(2)

1 .....

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2 .....

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(iv) Give **one** reason why the reduction in length eventually reaches a limit as more weights are added.

(1)

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(Total for question = 6 marks)

Q2.

Figure 9 shows a spring standing on a table.

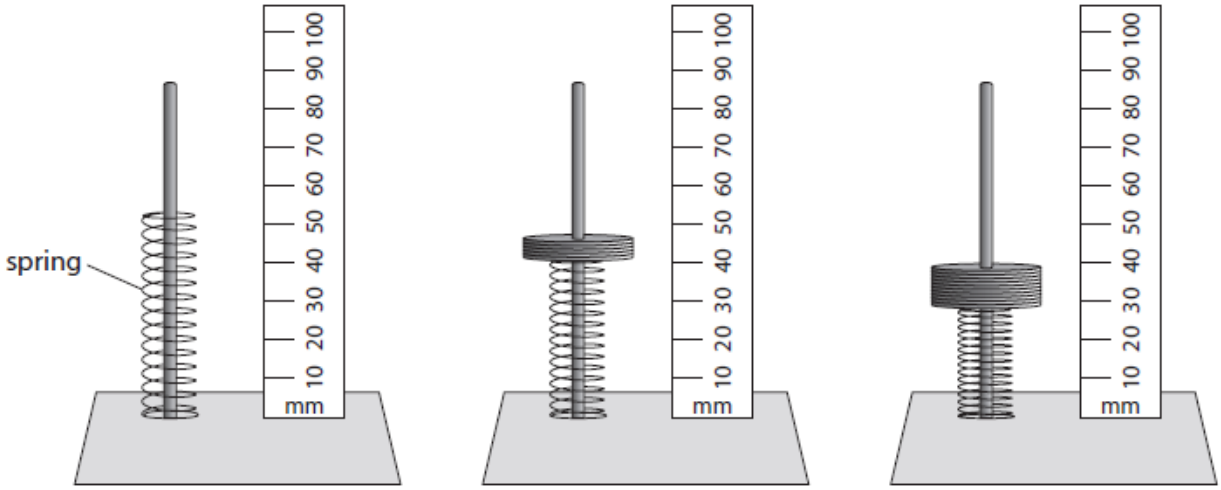


Figure 9a **Figure 9b** **Figure 9c**

Weights are added to the spring as shown in Figures 9b and 9c.

(i) Estimate the original length of the spring as shown in Figure 9a.

(1)

original length = ... mm

(ii) Describe how the reduction in the length of the spring when weights are added can be determined.

(2)

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.....

(iii) State **two** ways that the experimental procedure could be improved.

(2)

1 .....

.....

2 .....

.....

(iv) Give **one** reason why the reduction in length eventually reaches a limit as more weights are added.

(1)

.....

.....

(Total for question = 6 marks)

Q3.

A student sets up the apparatus shown in Figure 9.

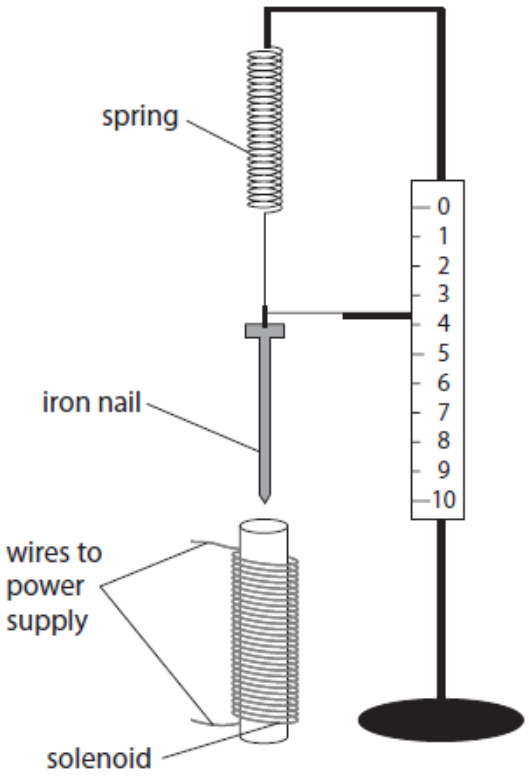


Figure 9

(i) When the current in the solenoid is switched on, the solenoid attracts the iron nail.

Describe how the student could use this apparatus to investigate how the size of the current in the solenoid affects the force of attraction between the solenoid and the iron nail.

(4)

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(ii) The spring constant of a different spring is 24 N/m.

The spring is extended from its unstretched length by 12 cm.

Calculate the energy transferred in extending the spring by 12 cm.

Use an equation selected from the list of equations at the end of this paper.

(2)

energy transferred = ... J

(Total for question = 6 marks)

Q4.

A student sets up the apparatus shown in Figure 9.

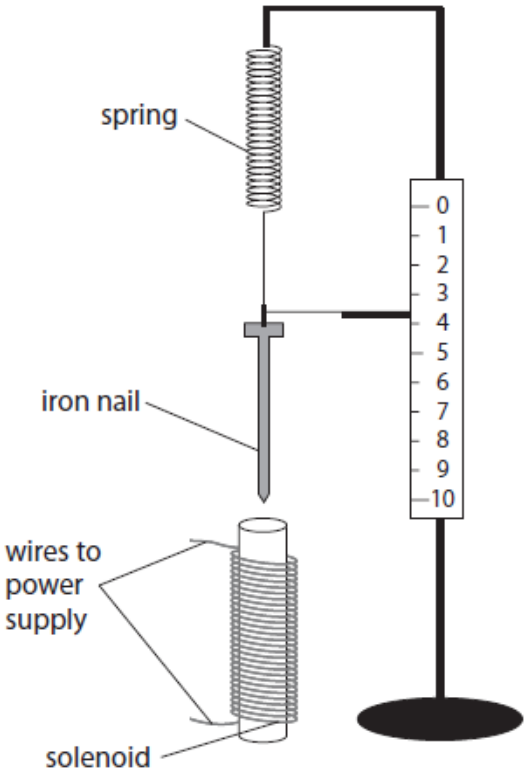


Figure 9

(i) When the current in the solenoid is switched on, the solenoid attracts the iron nail.

Describe how the student could use this apparatus to investigate how the size of the current in the solenoid affects the force of attraction between the solenoid and the iron nail.

(4)

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(ii) The spring constant of a different spring is 24 N/m.

The spring is extended from its unstretched length by 12 cm.

Calculate the energy transferred in extending the spring by 12 cm.

Use an equation selected from the list of equations at the end of this paper.

(2)

energy transferred = ... J

(Total for question = 6 marks)

Q5.

Figure 17 shows a crane lifting a concrete block from the bottom of a deep pool of water.
The top of the block is a distance, *h*, below the surface of the water.

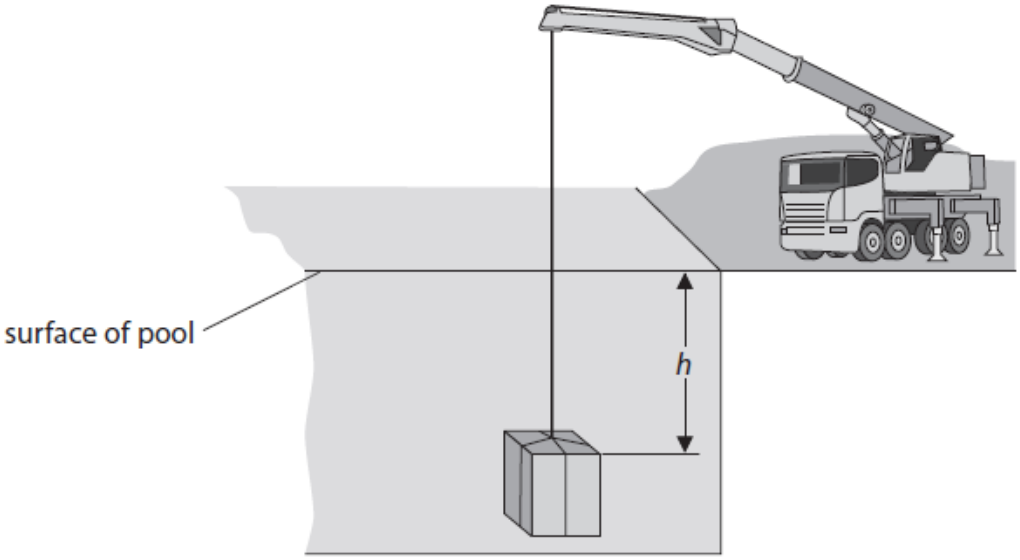


Figure 17

The force on the top of the block due to the water above it is 41 000 N.

The pressure due to the water on the top surface of the block is 66 000 Pa.

(i) Calculate the area of the top surface of the block.

(2)

area of the top surface of the block = ... m^2

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

Calculate the distance, *h*, between the top of the block and the surface of the water.

Gravitational field strength, *g*, is 10 N/kg.

Use an equation selected from the list of equations at the end of this paper.

(2)

h = ... m

(iii) Explain why there is an upthrust produced by the water on the block.

(2)

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* (iv) The crane raises the block until it is high enough out of the water to be loaded

on to a lorry.

The block moves upwards at a constant speed even though the lifting force in the cable changes.

Figure 18 shows the graph of how the lifting force changes while the block is being raised.

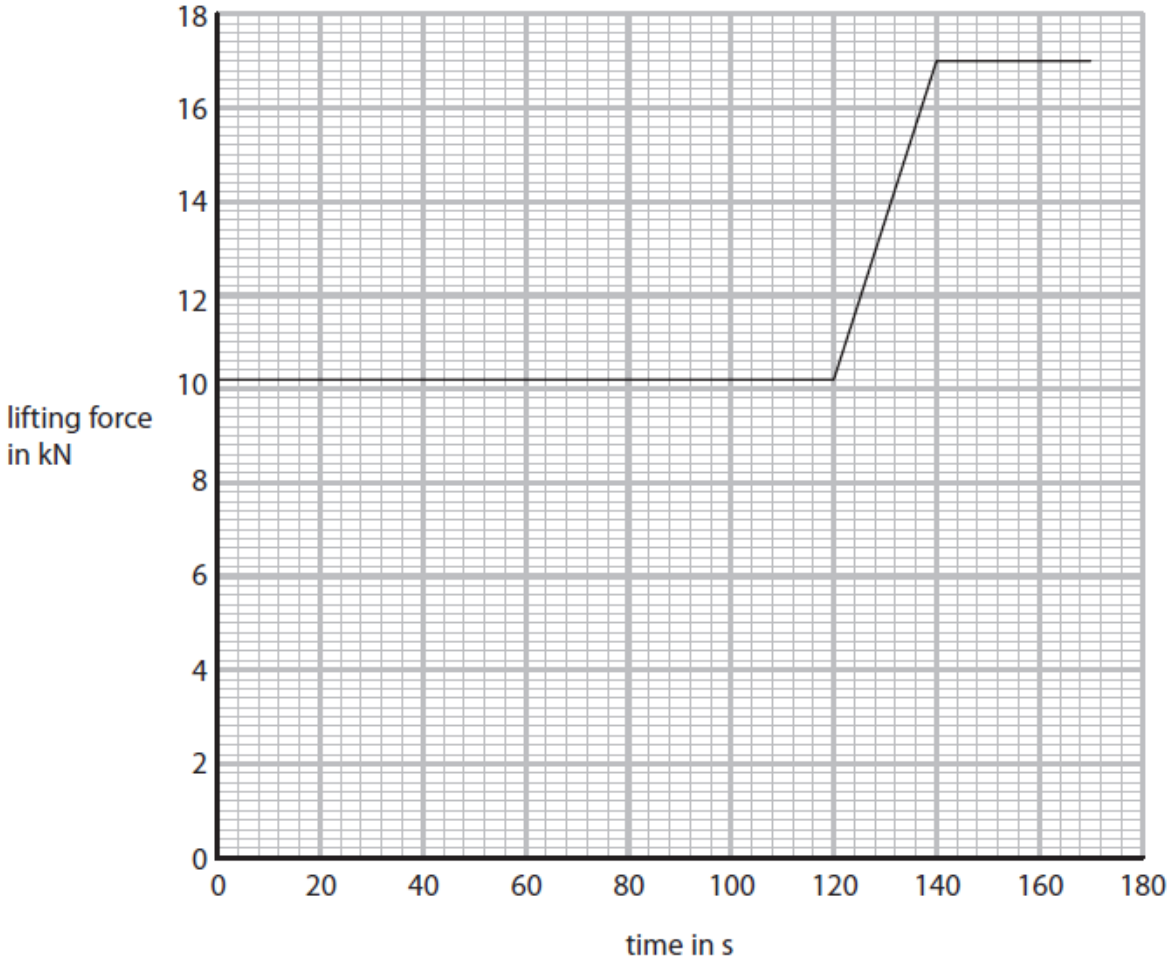


Figure 18

Explain why the lifting force changes as shown on the graph in Figure 18.
Include calculation(s) in your answer.

(6)

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(Total for question = 12 marks)

Q6.

Figure 8 shows some water in a tank.



Figure 8

(i) The bottom of the tank has an area of 0.80 m^2.

The force on the bottom of the tank, due to the water, is 2400 N.

Calculate the pressure, due to the water, on the bottom of the tank.

(3)

pressure = ... Pa

(ii) More water is added to the tank.

Explain how the pressure on the bottom of the tank changes when more water is added to the tank.

(2)

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(iii) Figure 9 shows an object on the bottom of the tank of water.

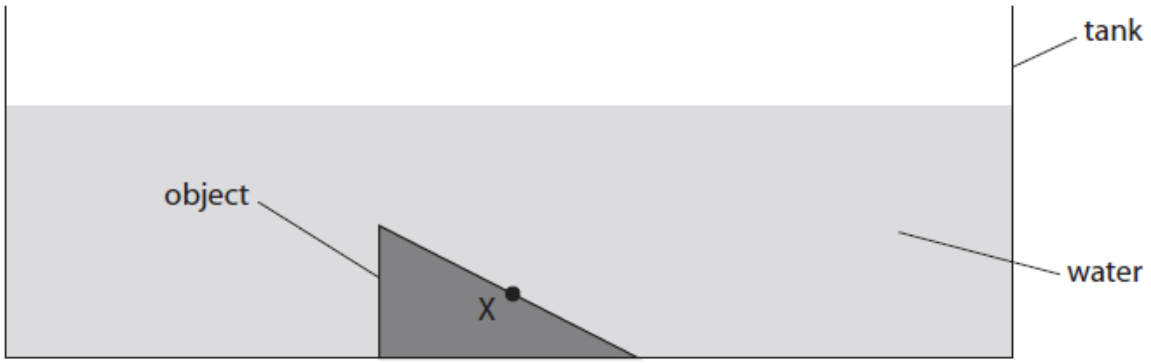


Figure 9

Draw an arrow on Figure 9 to show the direction of the force exerted by the water on the surface of the object at point X.

(1)

(Total for question = 6 marks)

Q7.

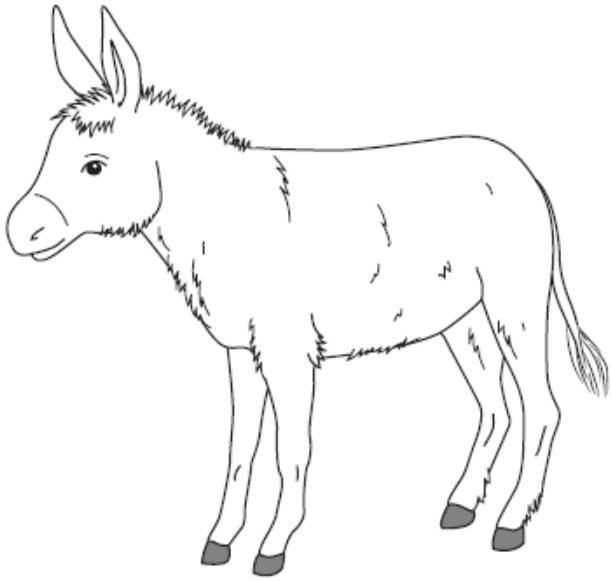


Figure 6

A donkey has a weight of 2500 N.

The area of each hoof is 0.022 m^2.

(i) Calculate the average pressure that the donkey exerts on the ground.

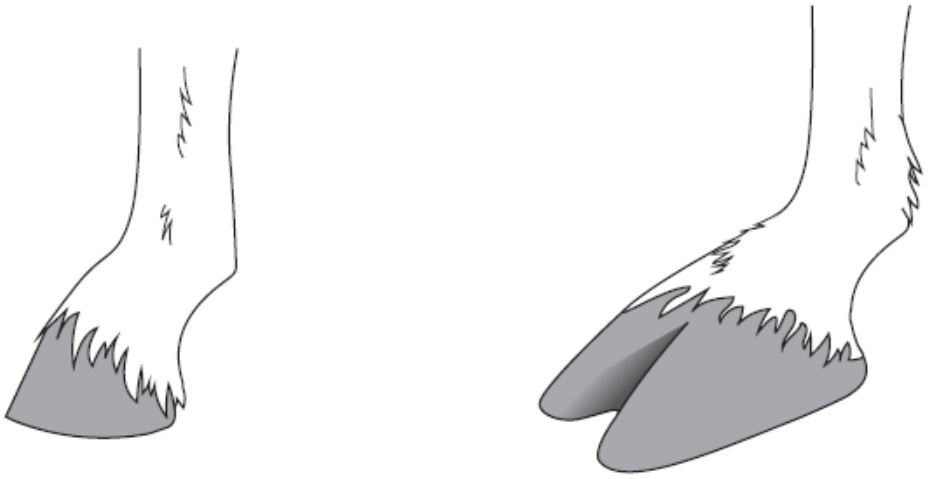
Use the equation

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

(2)

average pressure = ... Pa

(ii) Figure 7 shows how the shape of a camel's hoof is different from the shape of a donkey's hoof.



donkey hoof

camel hoof

Both diagrams are drawn to the same scale.

Figure 7

The camel and the donkey have the same mass.

Explain how a camel's hoof is a more suitable shape than a donkey's hoof for walking on soft ground.

(2)

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(Total for question = 4 marks)

Q8.

Another spring is extended.

The work done to extend the spring is 0.14 J.

The spring constant of the spring is 175 N/m.

Calculate the extension of the spring.

Use an equation selected from the list of equations at the end of this paper.

(3)

extension of spring = ... m

(Total for question = 3 marks)

Q9.

Another spring is extended.

The work done to extend the spring is 0.14 J.

The spring constant of the spring is 175 N/m.

Calculate the extension of the spring.

Use an equation selected from the list of equations at the end of this paper.

(3)

extension of spring = ... m

(Total for question = 3 marks)

Q10.

Figure 26 shows a glass U-tube containing water of density 1000 kg/m^3.

The water levels are the same on both sides of the U-tube.

Both ends of the U-tube are open to the atmosphere.

Atmospheric pressure is 101 000 N/m^2.

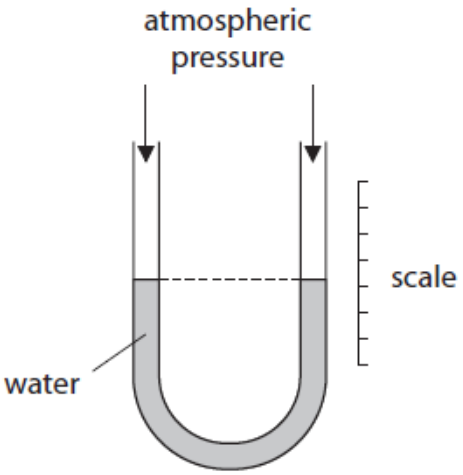


Figure 26

Figure 27 shows the U-tube with one side connected to a gas supply.

The difference in the levels of water, *h*, is 0.200 m.

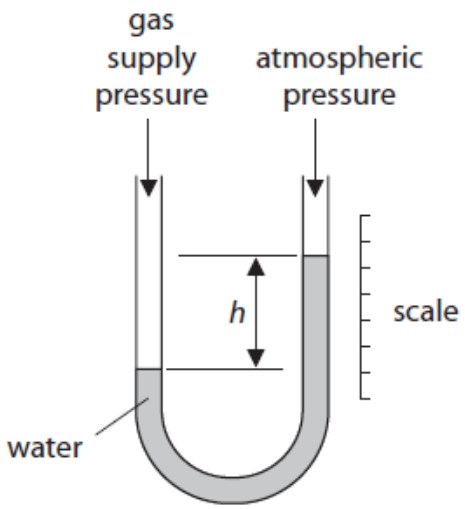


Figure 27

(i) Calculate the gas supply pressure.
Use an equation selected from the list of equations at the end of the paper.

(3)

pressure of gas supply = ... N/m^2

(ii) The measurement is repeated using a U-tube of larger cross-sectional area.

Explain why the value of *h* does not change.

(2)

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(Total for question = 5 marks)

Q11.

Figure 16 shows a beaker containing 150 g of water.



Figure 16

The cross-sectional area of the bottom of the beaker is 3.3×10^{-3} m^{-2}.

Calculate the pressure at the bottom of the beaker due to the water.

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

(2)

pressure = ... Pa

(Total for question = 2 marks)

Q12.

A spring is extended.

A force of 0.50 N gives an extension of 13 mm.

Calculate the spring constant *k* in N/m.

(3)

spring constant *k* = ... N/m

(Total for question = 3 marks)

Q13.

A different spring is extended.

A force of 0.50 N gives an extension of 13 mm.

Calculate the spring constant k in N/m.

(3)

spring constant k = ... N/m

(Total for question = 3 marks)

Q14.

Figure 14 shows an athlete using a fitness device.

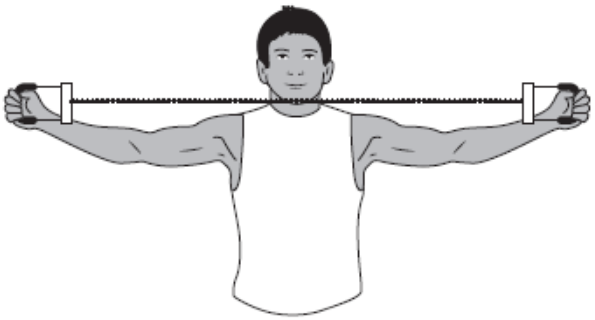


Figure 14

The athlete stretches the spring in the device by pulling the handles apart.

The spring constant of the spring is 140 N/m.

The athlete does 45 J of work to extend the spring.

The athlete takes 0.6 s to expand the spring.

(i) Calculate the useful power output of the athlete when stretching the spring.

(2)

useful power output of the athlete = ... W

(ii) Calculate the extension of the spring.

Use an equation selected from the list of equations at the end of this paper.

(3)

extension of the spring = ... m

(Total for question = 5 marks)

Q15.

Figure 7 shows an athlete using a fitness device.

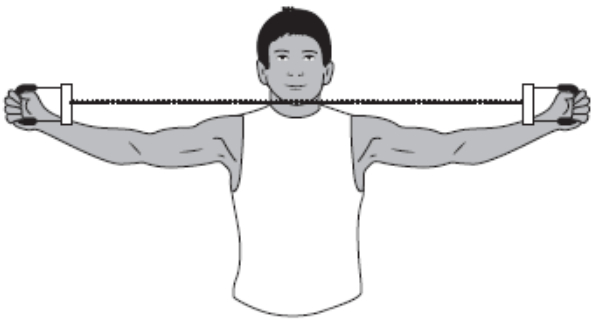


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The athlete stretches the spring in the device by pulling the handles apart.

The spring constant of the spring is 140 N/m.

The athlete does 45 J of work to extend the spring.

The athlete takes 0.6 s to expand the spring.

(i) Calculate the useful power output of the athlete when stretching the spring.

(2)

useful power output of the athlete = ... W

(ii) Calculate the extension of the spring.

Use an equation selected from the list of equations from the relevant equation sheet.

(3)

extension of the spring = ... m

(Total for question = 5 marks)

Q16.

Figure 2 shows a tank for holding water.

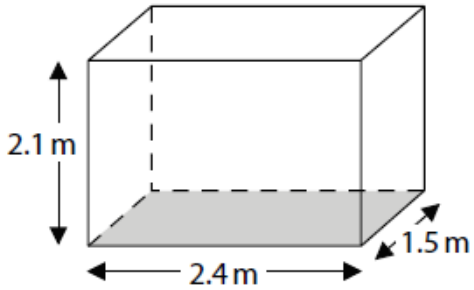


Figure 2

The tank has sides of 2.4 m, 2.1 m and 1.5 m.

The pressure at the bottom of the tank is 12 kPa.

(i) State the equation relating pressure, force and area.

(1)

(ii) Calculate the weight of water in the tank.

(4)

weight = ... N

(Total for question = 5 marks)

Q17.

A student carries out an investigation to show how pressure varies with depth in water.

A pressure sensor is attached to a rule.

The rule and pressure sensor are lowered into the water in a tank, as shown in Figure 8.

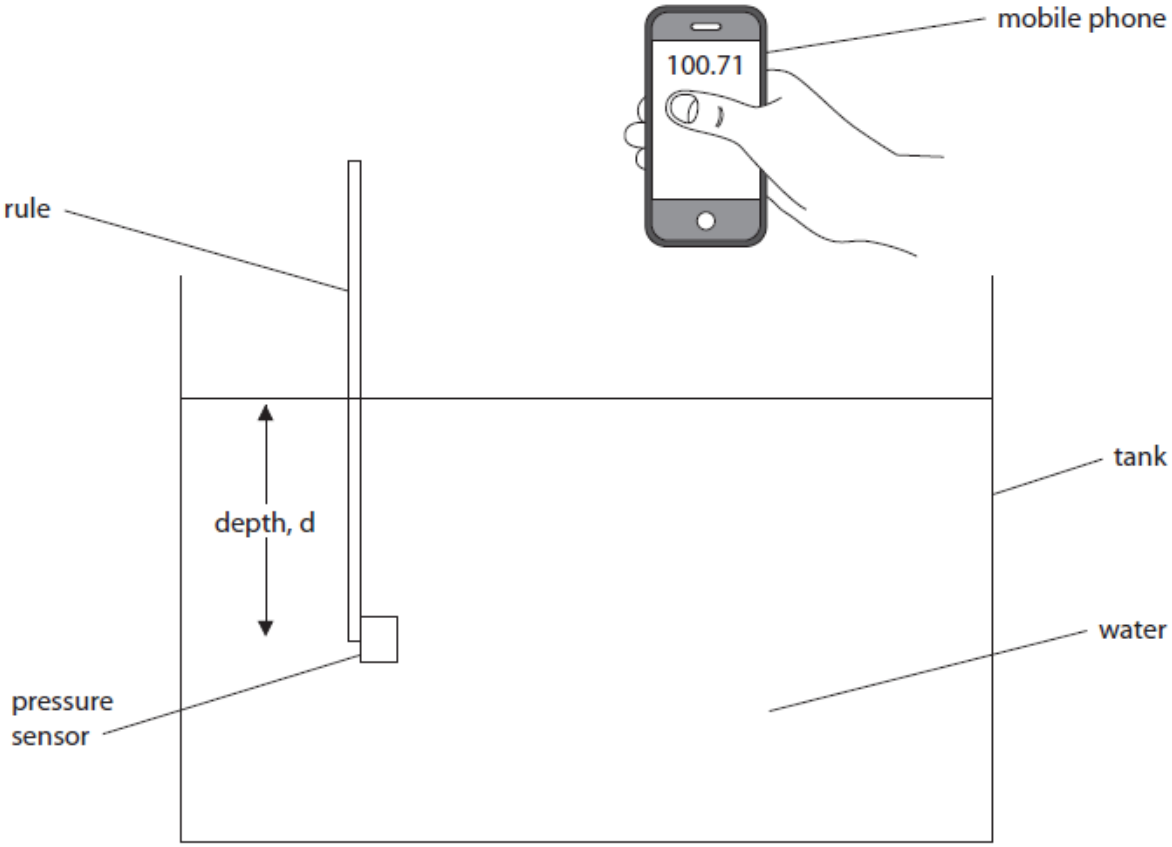


Figure 8

The depth of the pressure sensor below the surface of the water is read from the scale on the rule.

The pressure is displayed on the student's mobile phone which receives a signal from the pressure sensor.

Figure 9 gives some of the readings.

depth in m	pressure in kPa
0.050	99.15
0.100	99.70
0.150	100.15
0.200	100.70
0.250	101.15
0.300	101.70

Figure 9

Figure 10 shows a graph with some of the results plotted, but two of the points are missing.

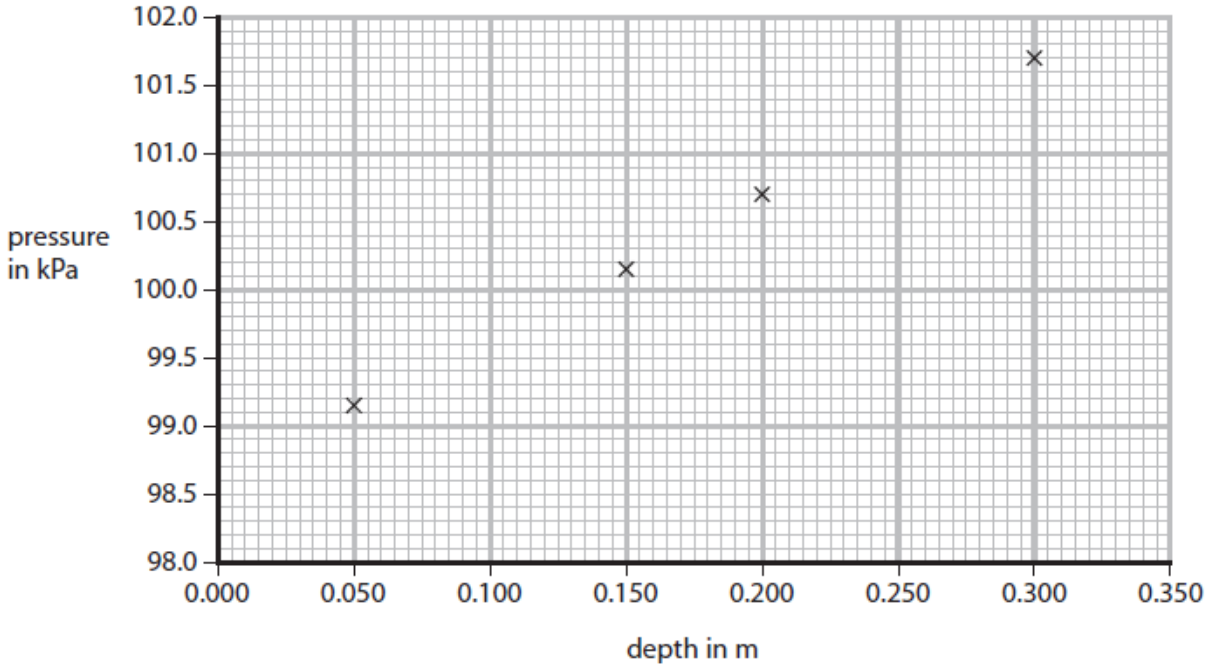


Figure 10

The student repeats the investigation using seawater and draws a graph of the results.

The seawater is more dense than the water used previously.

Compare the graph for seawater with the graph in Figure 10.

(2)

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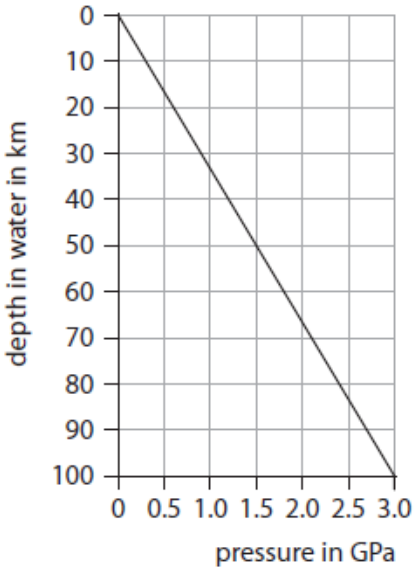
(Total for question = 2 marks)

Q18.

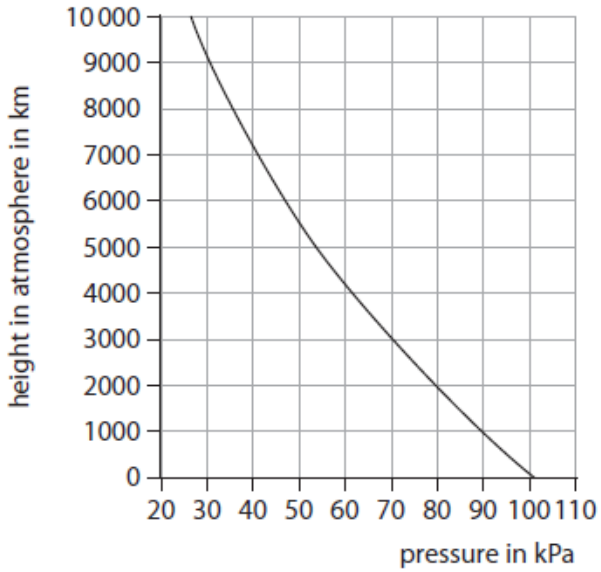
Figure 17 shows information about the pressures in the ocean and in the atmosphere of a distant planet.

Graph A shows the variation of pressure as the depth in the ocean increases.

Graph B shows the variation of pressure as the height in the atmosphere increases.



Graph A



Graph B

Figure 17

(i) Use information from Graph A to obtain a value for the density of the ocean water.

Use an equation selected from the list of equations at the end of this paper.

(4)

density = ... kg/m^3

* (ii) Explain the similarities and differences in the pressure variations shown in graphs A and B.

Your answer should refer to both the particle model (kinetic theory) and to density.

(6)

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(Total for question = 10 marks)

Q19.

A student investigates the stretching of a long piece of rubber.

Figure 15 shows the apparatus to be used.

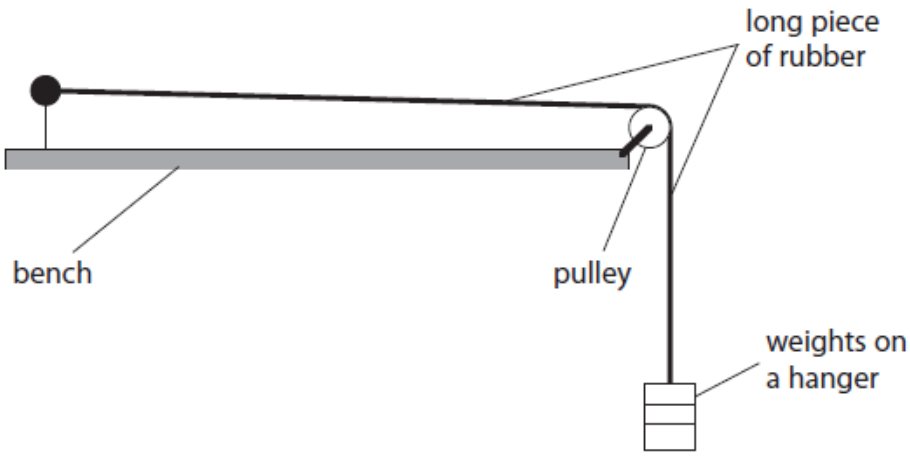


Figure 15

The student puts just enough weight on the weight hanger to make the piece of rubber just tight.

The student wants to plot a graph to show how the extension of the piece of rubber varies with the force used to stretch it.

The student adds a known weight to the weight hanger.

(i) Describe how the student could measure the extension of the rubber when

he adds another weight to the weight hanger.

(2)

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(ii) The student obtains a series of values of force and extension while loading the

piece of rubber and then unloading it.

Figure 16 shows the graph of the student's values.

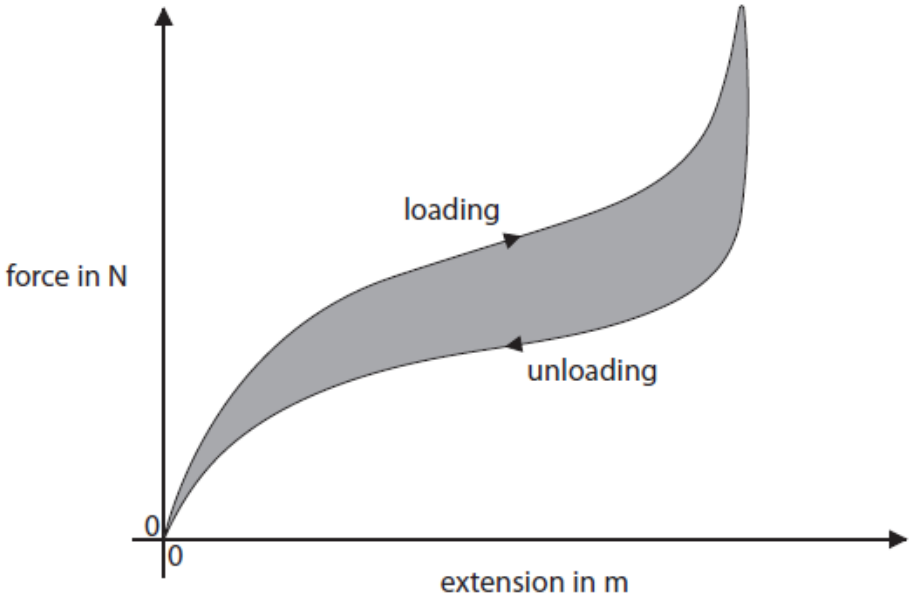


Figure 16

Explain how the shape of this graph shows that the distortion of the piece of rubber being stretched is different from the distortion of a spring being stretched.

(2)

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(Total for question = 4 marks)

Q20.

A student investigates the stretching of a long piece of rubber.

Figure 8 shows the apparatus to be used.

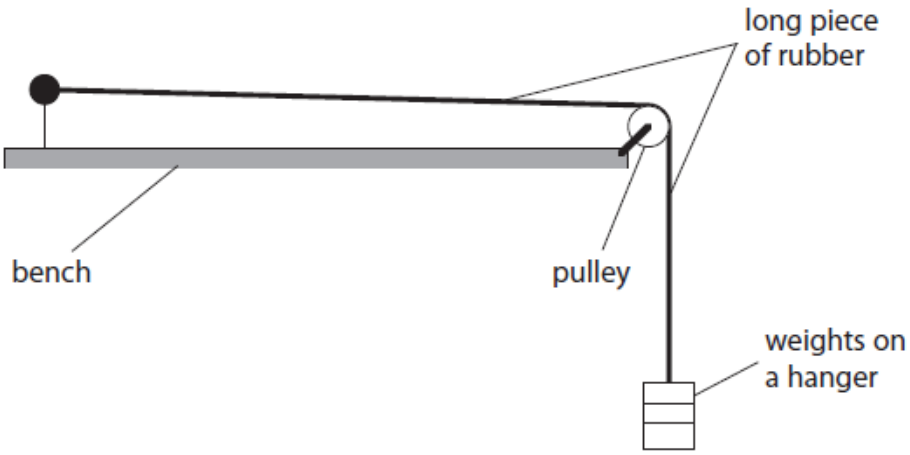


Figure 8

The student puts just enough weight on the weight hanger to make the piece of rubber just tight.

The student wants to plot a graph to show how the extension of the piece of rubber varies with the force used to stretch it.

The student adds a known weight to the weight hanger.

(i) Describe how the student could measure the extension of the rubber when he adds another weight to the weight hanger.

(2)

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(ii) The student obtains a series of values of force and extension while loading the piece of rubber and then unloading it.

Figure 9 shows the graph of the student's values.

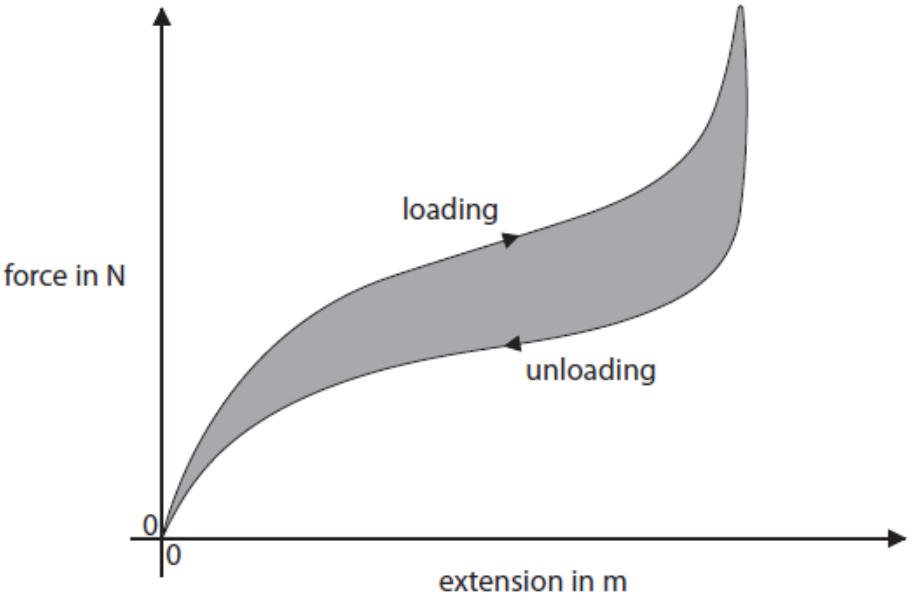


Figure 9

Explain how the shape of this graph shows that the distortion of the piece of rubber being stretched is different from the distortion of a spring being stretched.

(2)

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(Total for question = 4 marks)

Q21.

Figure 11 shows two drawings of the same person on a bed.

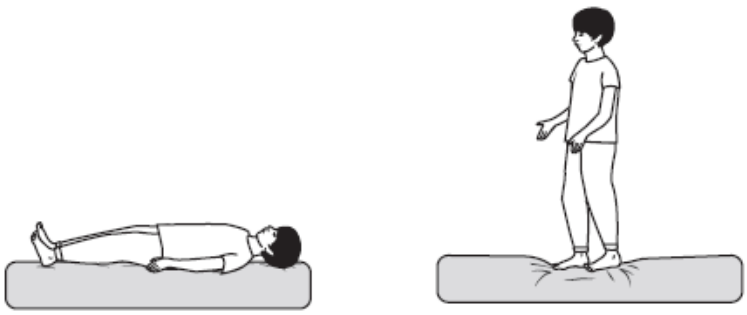


Figure 11

Explain why the person exerts a different pressure on the bed when standing up than when lying down.

(2)

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(Total for question = 2 marks)

Q22.

Figure 3 shows three containers A, B, and C.

Each container contains a liquid, as shown.

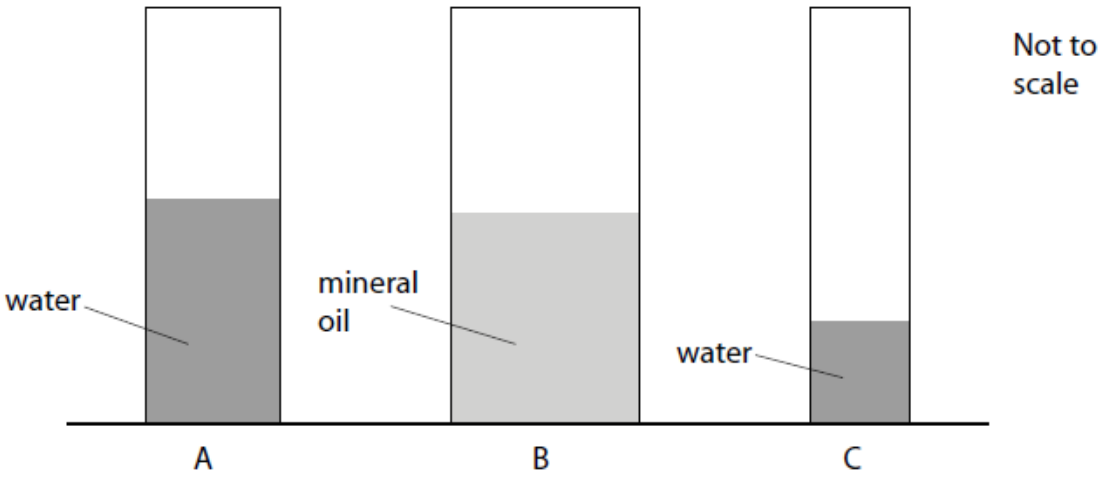


Figure 4 gives some data about the liquids and containers.

container	area of base (cm^2)	name of liquid	density of liquid (g/cm^3)	depth of liquid in container (cm)
A	16	water	1.00	50.00
B	32	mineral oil	0.91	50.00
C	12	water	1.00	25.00

Figure 4

Explain which container has the highest pressure at the bottom, and which container has the lowest.

Use information from Figure 3 and Figure 4.

(3)

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(Total for question = 3 marks)

Q23.

* Figure 26 shows the submarine stationary and submerged at a depth of 10 m.

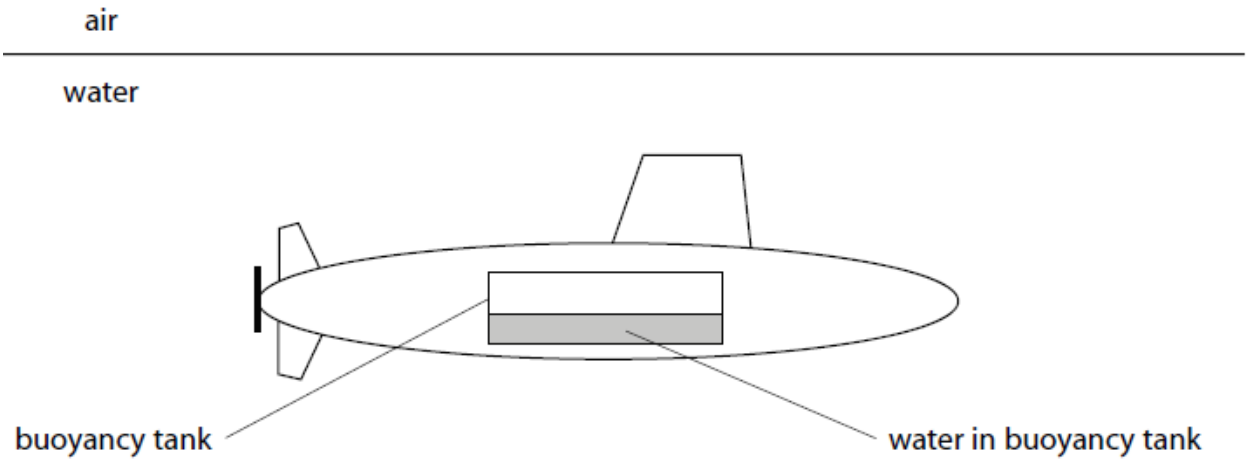


Figure 26

Explain how pumping water into and out of the buoyancy tank affects the depth of the submarine below the surface.

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(Total for question = 6 marks)

Q24.

*Figure 28 shows a cross-section of a boat floating in water and the same boat with a load inside.

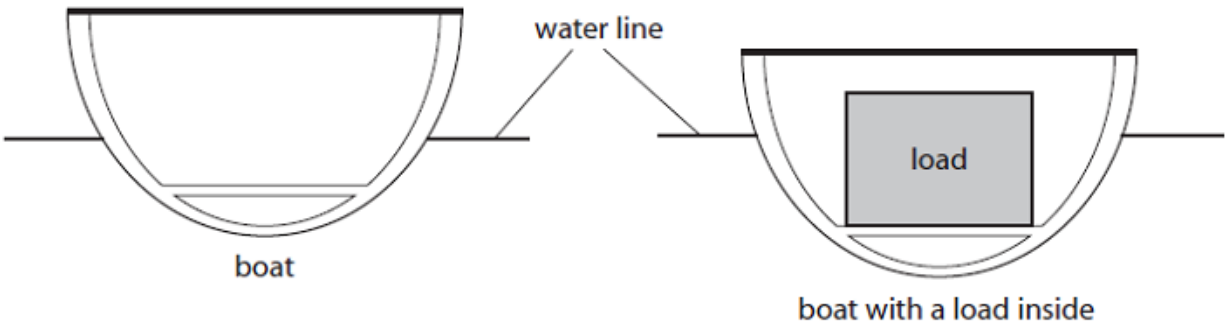


Figure 28

The boat floats lower in the water when there is a load inside the boat.

Explain why the boat floats in water and why the boat floats lower in the water when there is a load inside the boat.

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

(6)

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(Total for question = 6 marks)

Q25.

Figure 10 is a graph showing how the atmospheric pressure changes with the height above sea level on the Earth's surface.

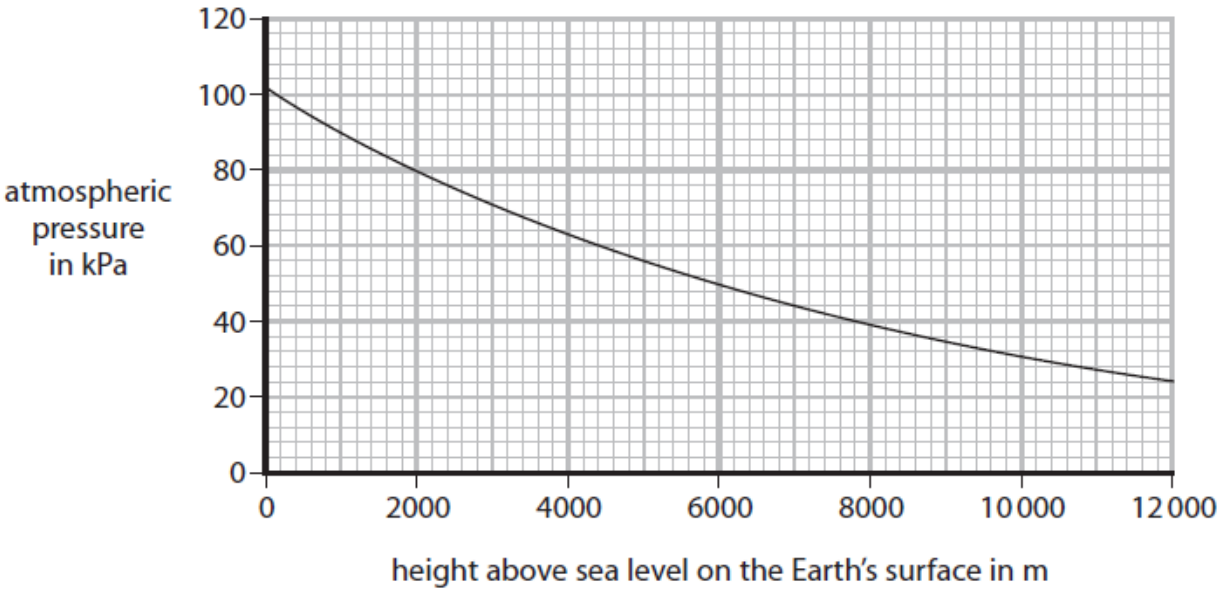


Figure 10

(i) An aeroplane descends from 6000 m to 2000 m.

Use the graph to find the change in atmospheric pressure as the aeroplane descends.

(2)

change in pressure = ... kPa

(ii) Suggest **one** reason why the atmospheric pressure is greater at 2000 m than at 6000 m.

(1)

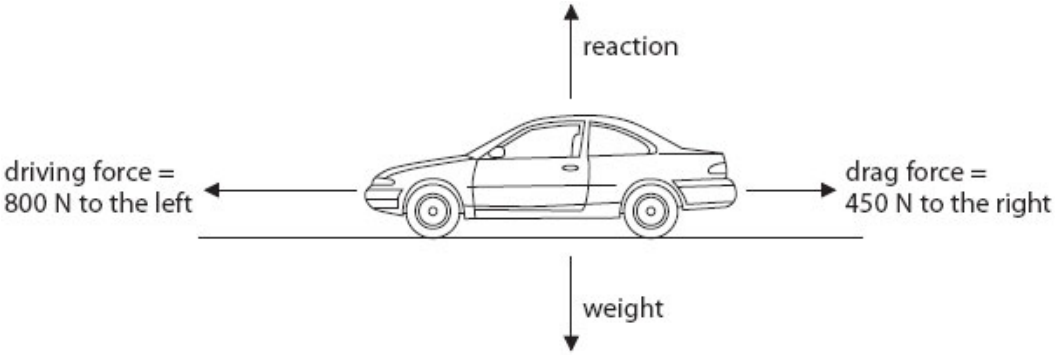
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(Total for question = 3 marks)

Q26.

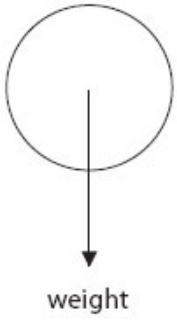
The diagram shows the forces acting on a car which is travelling along a flat straight road.



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	changing	greater	smaller	zero

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 .....

Q27.

Figure 13 shows a diagram of a device for lifting heavy loads.

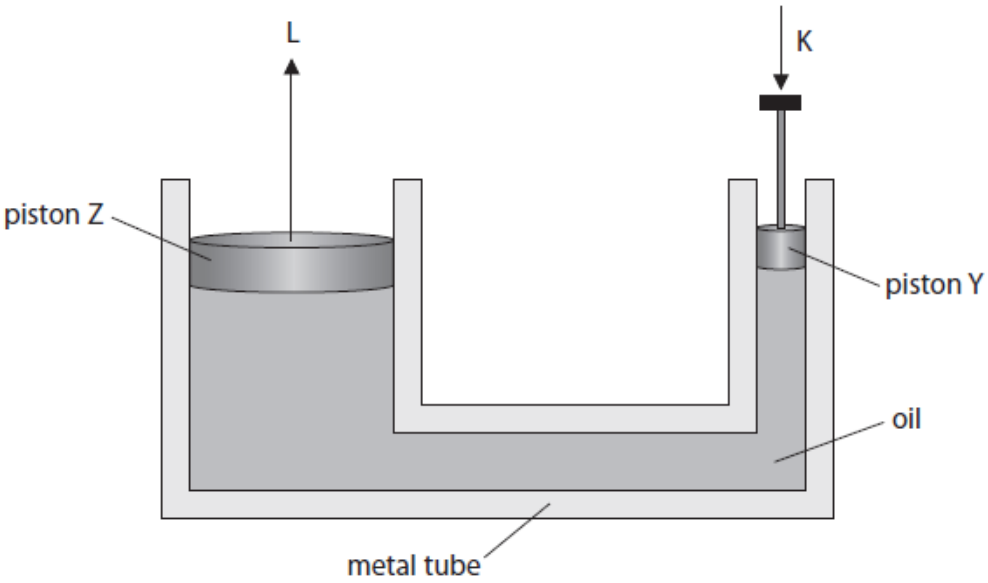


Figure 13

The metal tube is filled with oil.

The piston Y is pushed down with a force K.

This produces a force L on piston Z.

The pressure exerted on the oil by piston Y is the same as the pressure exerted by the oil on piston Z.

Explain the difference between the size of force K and the size of force L.

(3)

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(Total for question = 3 marks)

Q28.

Figure 2 shows a tank for holding water.

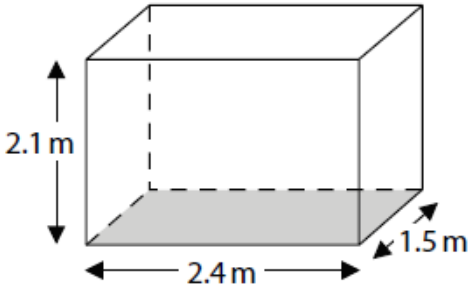
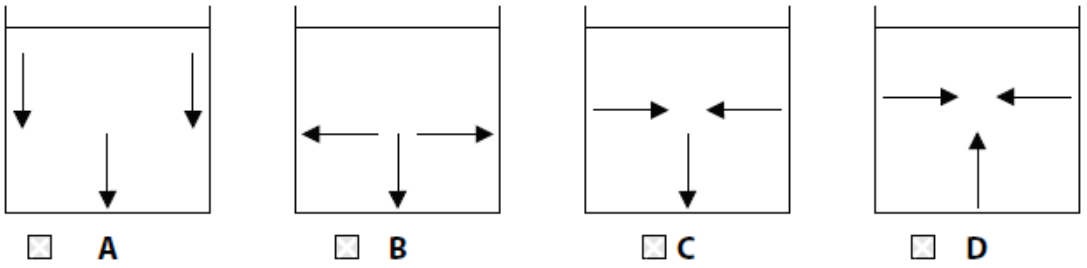


Figure 2

Which diagram shows the direction of the forces from the water on the inside of the tank?

(1)



(Total for question = 1 mark)

Q29.

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 ☒.

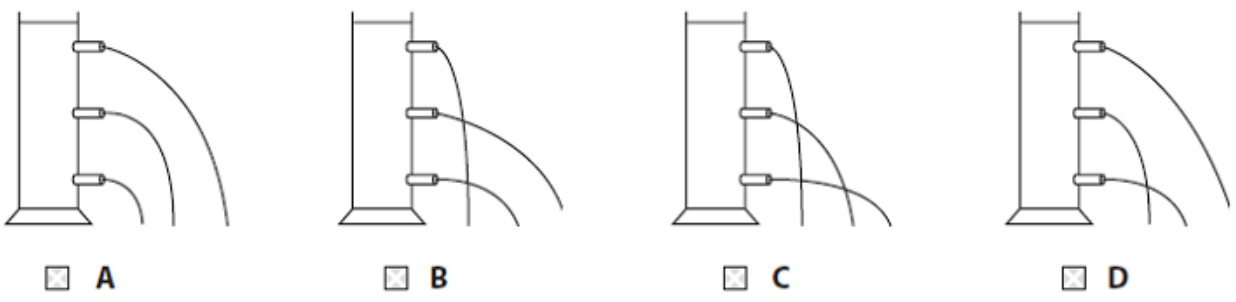
Figure 25 shows four identical metal cans, each filled with water to the same level.

Each can has three tubes.

Water comes out of each tube.

Which of these shows the correct pattern of water coming out of the tubes?

(1)



(Total for question = 1 mark)

Q30.

A student uses a digital calliper to measure the length of a spring, as shown in Figure 10.

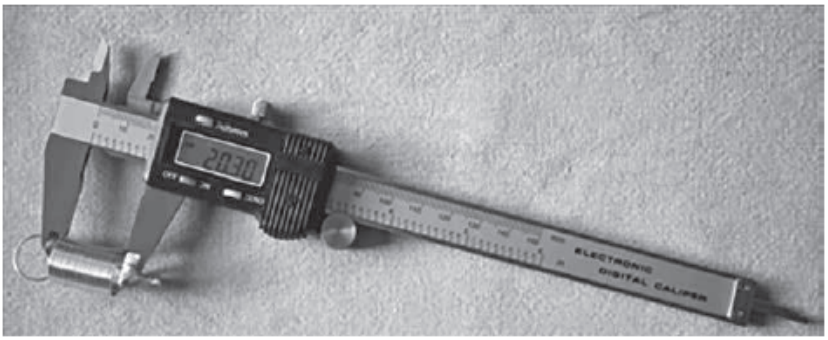


Figure 10

The spring is bendy and difficult to measure.

The student takes the six readings shown in Figure 11.

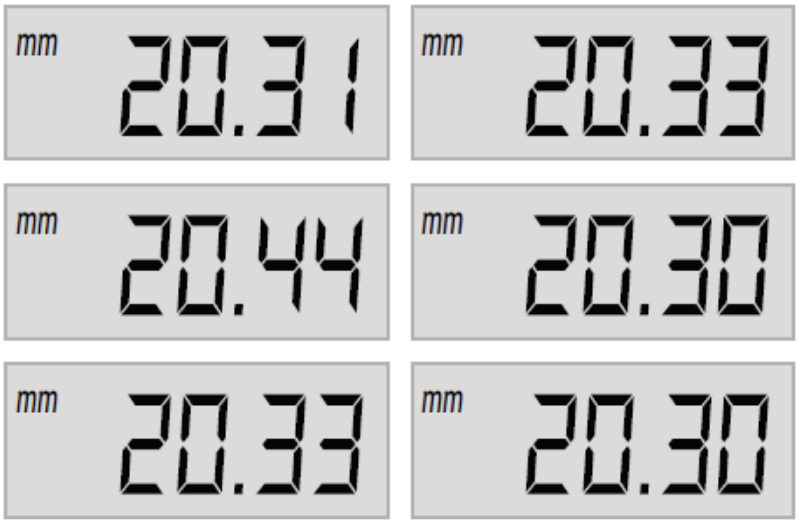


Figure 11

(a) Calculate the average length of the spring.

(2)

average length = ... mm

(b) The student investigates the stretching of a spring with the equipment shown in Figure 12.

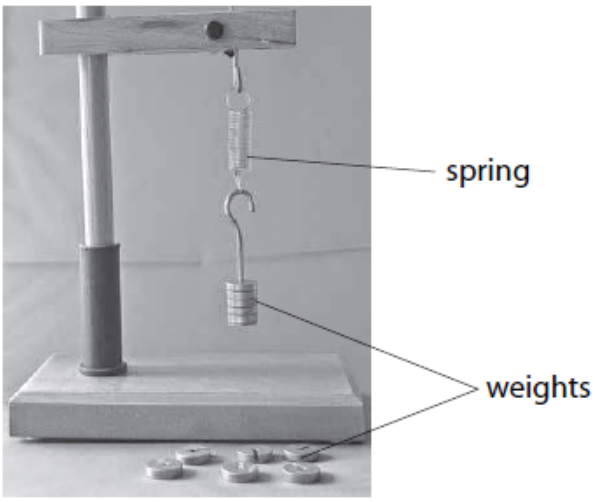


Figure 12

The student investigates the extension of the spring using six different weights.

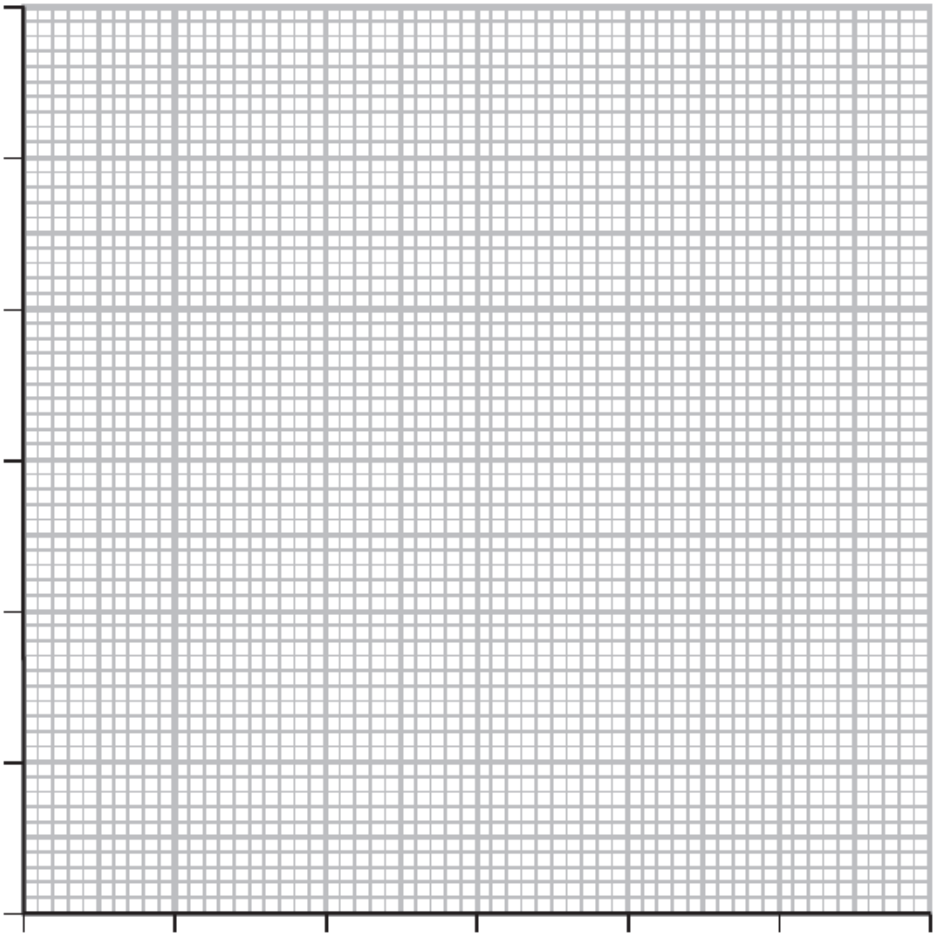
The results are shown in Figure 13.

weight (N)	extension (mm)
0.20	4.0
0.40	8.0
0.60	12.0
0.80	16.0
1.00	20.0
1.20	24.0

Figure 13

(i) Draw a graph for the readings, using the grid shown.

(3)



(ii) The student writes this conclusion:

'*The extension of the spring is directly proportional to the weight stretching the spring.*'

Comment on the student's conclusion.

(3)

.....

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(c) The student extends the investigation by finding information about the stretching of wires.

The student finds the graph shown in Figure 14 for the stretching of a wire.

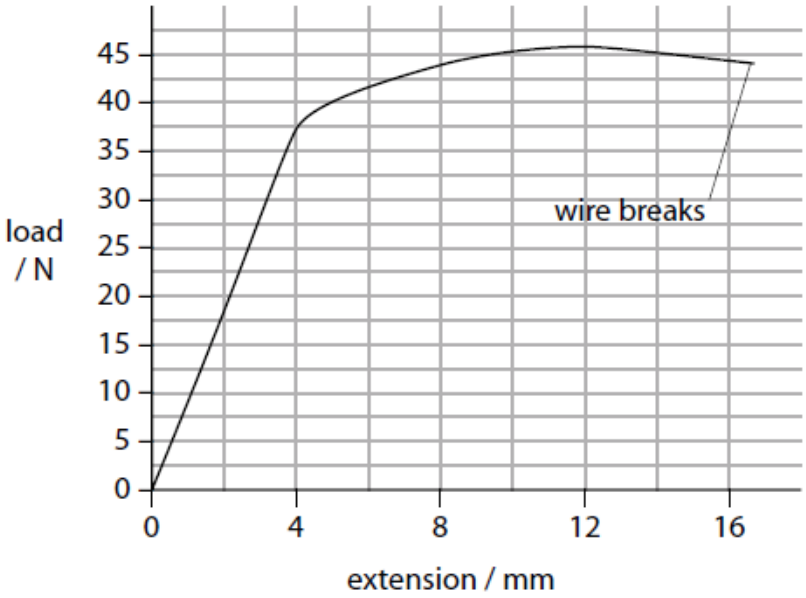


Figure 14

Describe the non-linear stretching of the wire shown in Figure 14.

(3)

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.....

.....

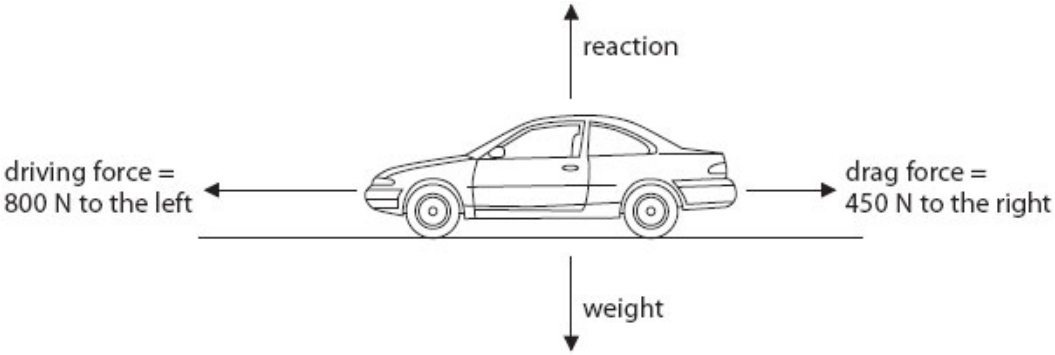
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(Total for question = 11 marks)

Q31.

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

(2)

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

Calculate the weight of the car.

gravitational field strength = 10N/kg

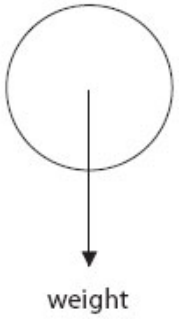
(2)

weight of car = ...N

(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	changing	greater	smaller	zero

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 is 8 marks)

Q32.

Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

A student carries out an investigation to show how pressure varies with depth in water.

A pressure sensor is attached to a rule.

The rule and pressure sensor are lowered into the water in a tank, as shown in Figure 8.

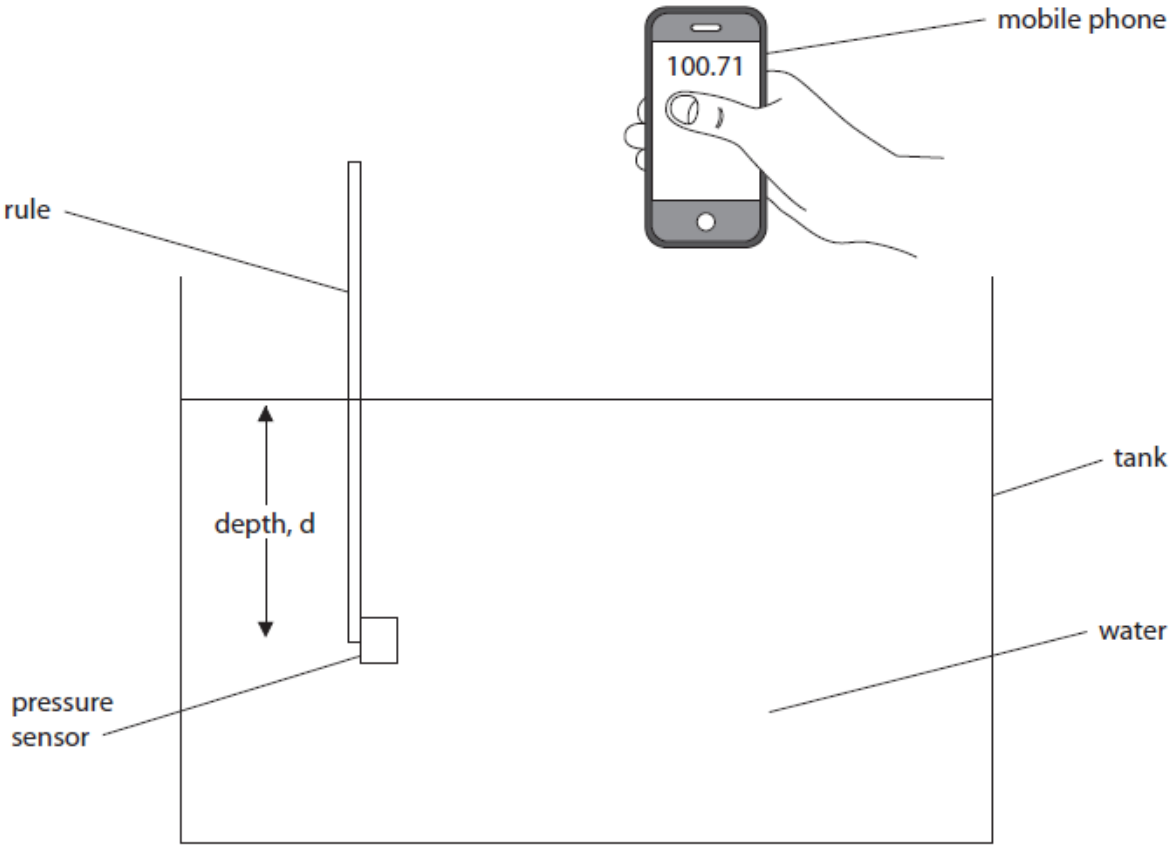


Figure 8

The depth of the pressure sensor below the surface of the water is read from the scale on the rule.

The pressure is displayed on the student's mobile phone which receives a signal from the pressure sensor.

Figure 9 gives some of the readings.

depth in m	pressure in kPa
0.050	99.15
0.100	99.70
0.150	100.15
0.200	100.70
0.250	101.15
0.300	101.70

Figure 9

Figure 10 shows a graph with some of the results plotted, but two of the points are missing.

Figure 10 shows a graph with some of the results plotted, but two of the points are missing.

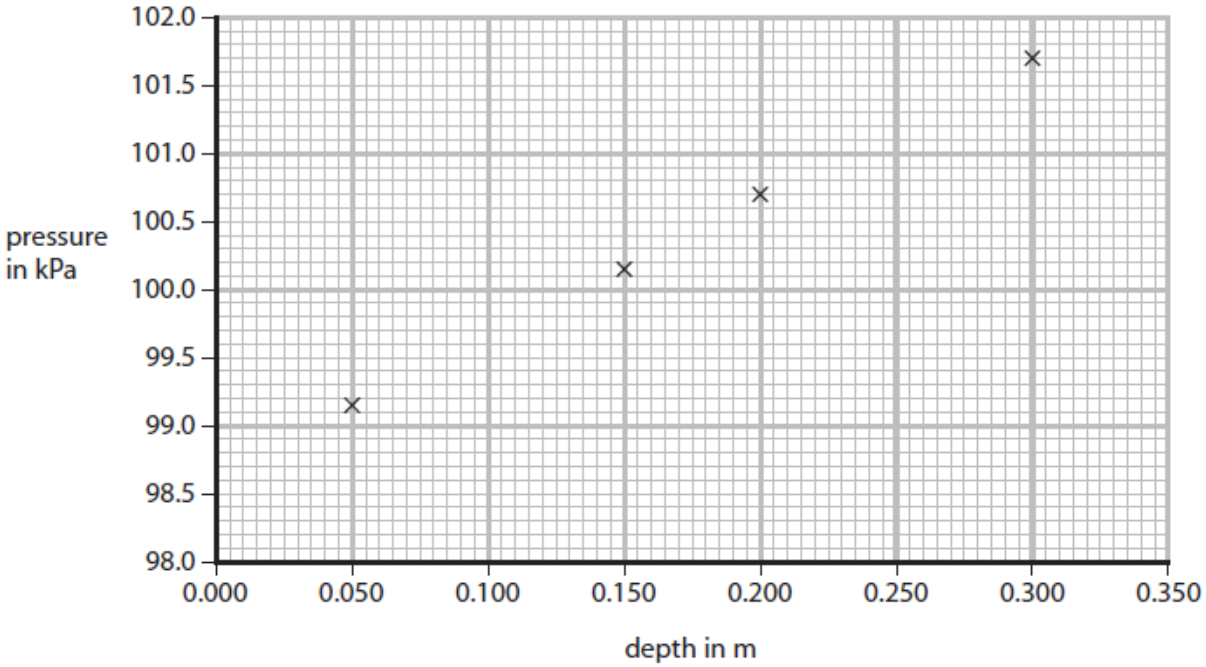


Figure 10

(i) Plot the two missing points on the graph.

(2)

(ii) Draw a line of best fit through the points on the graph.

(1)

(iii) Which of the following equations represents the variation of pressure with depth of water below the surface?

(1)

☒ **A** $y = ax^2 + b$

☒ **B** $y = mx$

☒ **C** $Y = mc - x$

☒ **D** $y = mx + c$

(iv) Use the graph in Figure 10 to predict the pressure at the surface of the water.

(1)

pressure at the surface of the sea water = ... kPa

(Total for question = 5 marks)

Q33.

A student is interested in the way that submarines are controlled.

She has several regular wooden blocks, a set of weights and a tank of water. Wood floats in water.

The student plans to immerse the wooden blocks fully in the water and investigate the relationship between the upthrust and the weight of water displaced.

Describe how she should determine **one** of the variables in this investigation.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)