International Ordinary Level

MASS CLASS

PRACTICE

PAST PAPERS WORK BOOK

INTERNATIONAL ORDINARY LEVEL

PHYSICS

Leading International School Senior Teacher

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1 (a) Diagram 1 shows a plastic bottle containing water.

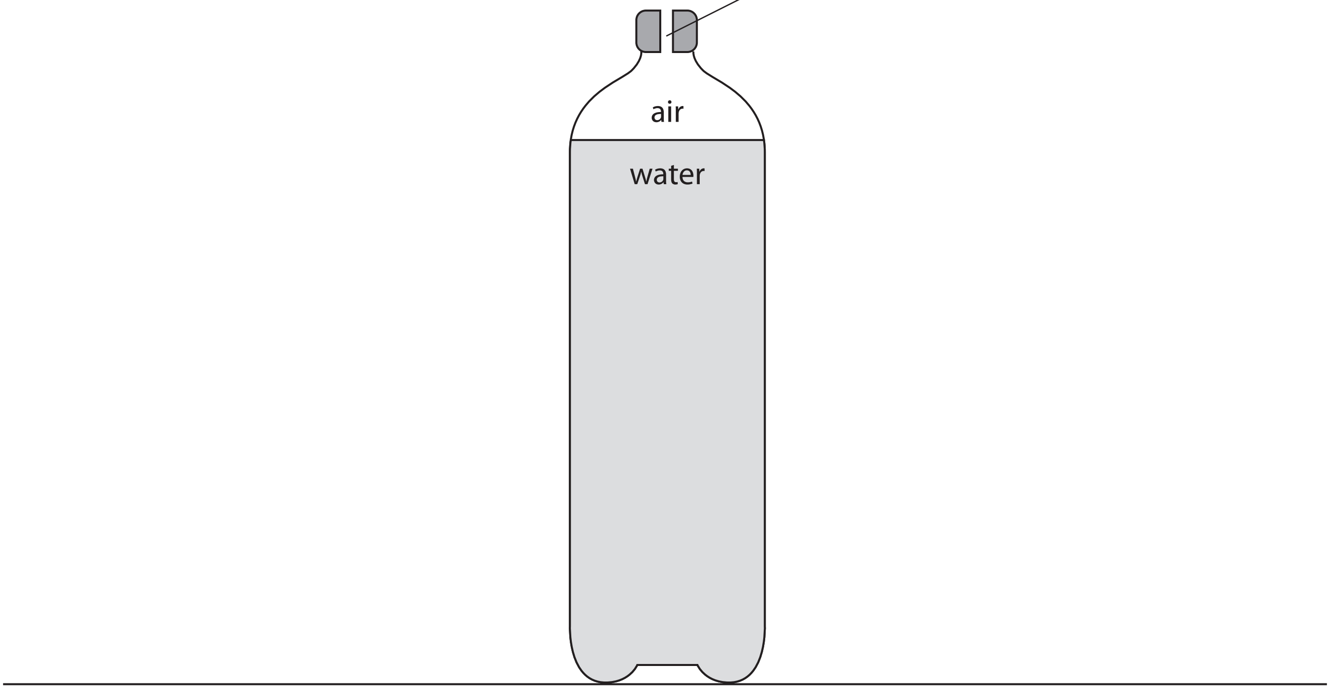


Diagram 1

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

(1)

Pressure (difference) = height × density × g

(ii) The pressure difference between the surface of the water and the water at the bottom of the bottle is 2300 Pa.

Calculate the depth of water in the bottle.

Give your answer in cm.
[density of water = 1000 kg / m^3]

(3)

Pressure (difference) = height × density × g
2300 = h × 1000 × 10
h = 2300 / (1000 × 10)
h = 23 cm

depth = 23 cm

(b) Three holes are made in the bottle at positions A, B and C.

Diagram 2 shows the path of the water leaving the bottle from hole B.

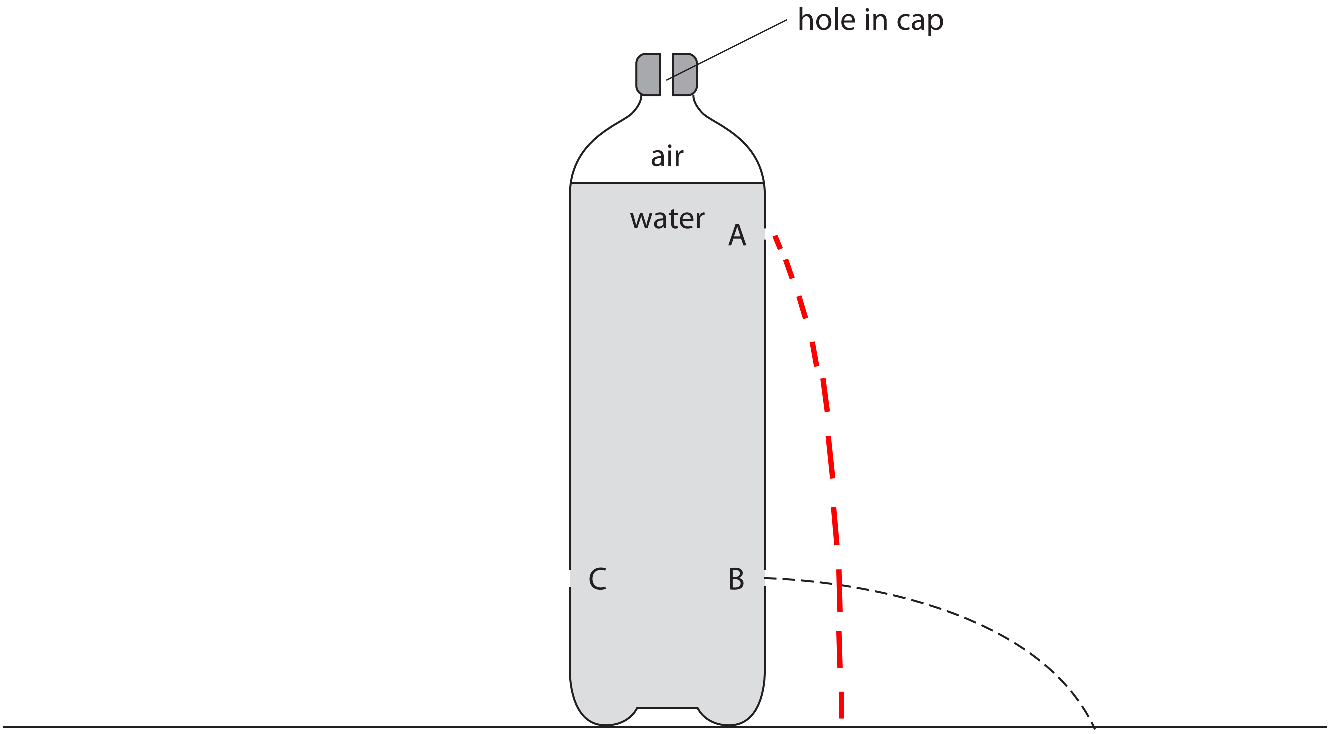


Diagram 2

(i) Draw a line on diagram 2 to show the path of the water leaving the bottle from hole A.

(1)

(ii) Explain the path of the water leaving the bottle from hole A.

(2)

Pressure is lower at A.

Force acting on water at A is less.

Water leaves the bottle at a lower speed.

So lower Kinetic energy is at A.

(iii) Hole C is at the same depth in the bottle as hole B but on the opposite side of the bottle.

Explain the shape of the path of the water leaving the bottle from hole C.

(3)

Path from C is identical and symmetrical to path from B.

Because pressure is the same;

Pressure acts (equally) in all directions at same level.

(iv) Suggest why there is a hole in the cap of the bottle.

(1)

It allows air to enter the bottle as water level falls.

2 The photograph shows a vertical drop ride at an amusement park.

(Source: Kenneth Sponsler/Shutterstock)

The car is pulled to the top of a vertical shaft and then released from rest.

The car then falls freely because of the force of gravity.

(a) Calculate the speed of the car when it has fallen 18 m.

(3)

$v^2 = u^2 + 2as$

$v^2 = 0 + (2 \times 10 \times 18)$

$v^2 = \sqrt{360}$

$v = 19$ m/s

speed = ...19........ m/s

(b) (i) State the formula linking kinetic energy, mass and speed.

(1)

kinetic energy = ½ × mass × speed ^{2}

(ii) The mass of the car and its passengers is 2.1 tonnes.

Calculate the kinetic energy of the car when it has fallen 18 m.

[1 tonne = 1000 kg]

(2)

kinetic energy = ½ × mass × speed ^{2}

KE = 0.5 × 2100 × 192
KE = 380 000 J

kinetic energy = 380 000 J

(c) The actual speed of the car when it has fallen 18 m is lower than the value calculated in (a).

Describe the energy transfers occurring from immediately before the car was released to when the car has fallen 18 m.

Refer to stores and transfers in your answer.

(4)

Energy is transferred from a gravitational energy to a kinetic energy.

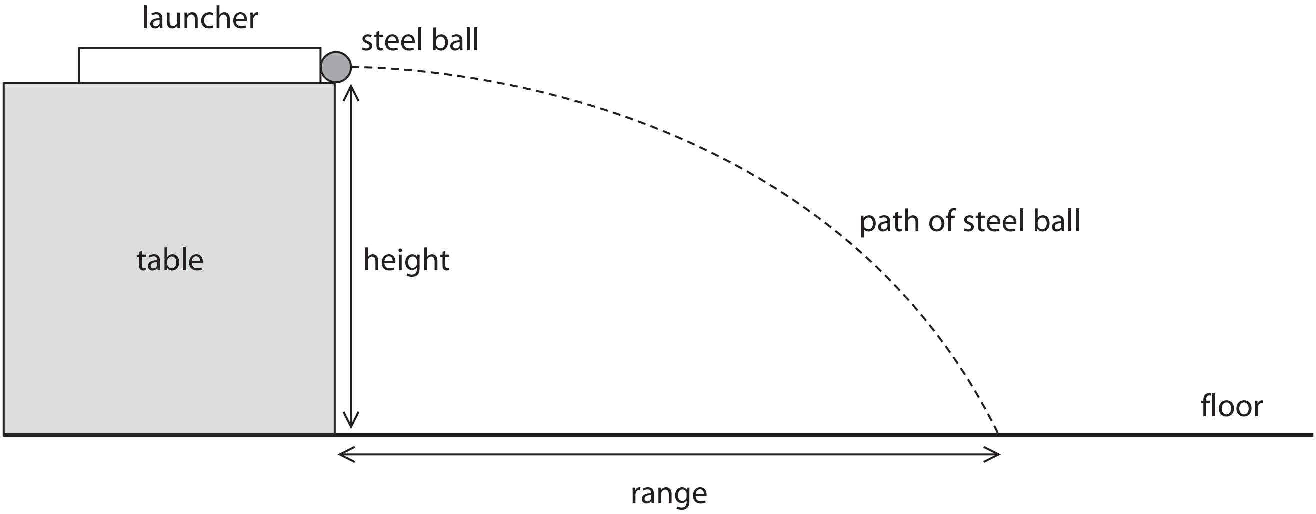
Then energy is transferred to a thermal energy store of car and surroundings.

Energy is transferred mechanically.

Energy can be transferred due to friction by radiation or heating.

3 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)

Height is independent variable. At least five different heights should be tested.

Range is dependent variable.

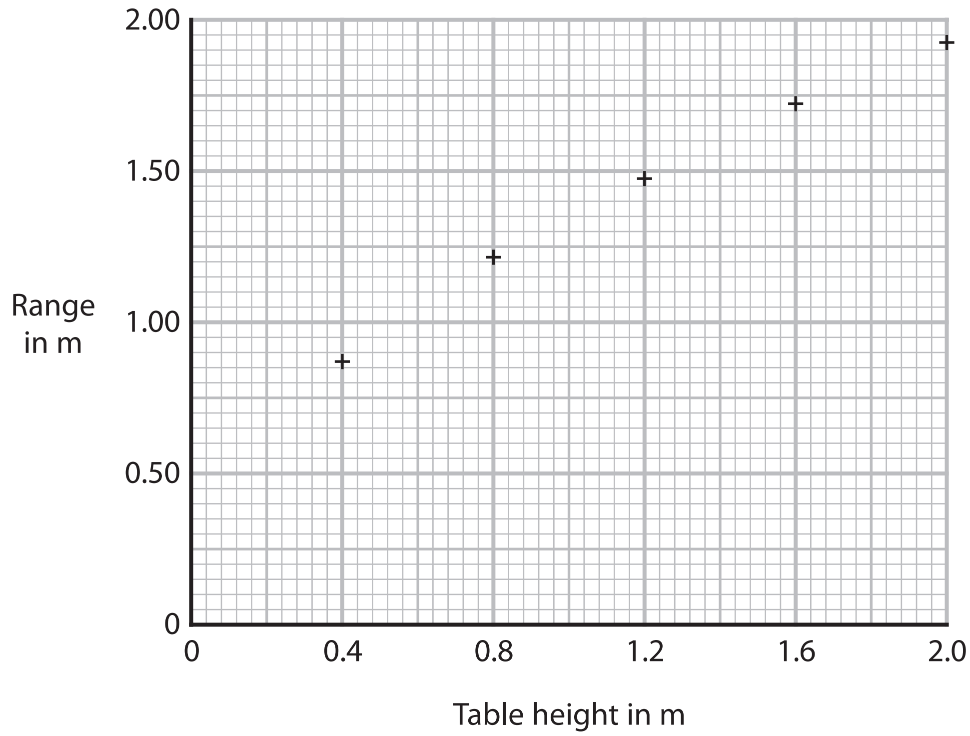
Control variable could be launch speed, launch force, angle of launch, same ball

Repeating process at each height to find mean and to identify anomalies.

Ruler , tape or metre stick can be used to measure height and range.

See where ball lands.

(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)

0.15-0.25 m

height = 0.18 m

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

(1)

Both variables are continuous

(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)

range = 1.92m   when height = 2.0m

1.92 = launch speed × √ 2/5
launch speed = 1.92 / √ 0.4
launch speed = 3.0 m/s

launch speed = ...3........ m / s

4 The drawing shows a camel and a person in a desert.

(Source: © Hennadii H/Shutterstock)

(a) Describe a method you could use to find the pressure a person exerts on the ground when standing on two feet.

(4)

I could take measurement of area of foot by drawing round foot.

Then I could take measurement of mass using a balance / scale(s)

Then I could us the formula

W = mg and

Pressure = F ÷ A

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(b) The total area of contact of the camel's feet with the ground is 1300 cm^2.

The mass of the camel is 660 kg.

Calculate the pressure this camel exerts on the ground.

(3)

W = mg
weight = 660 × 10 = 6600 (N)

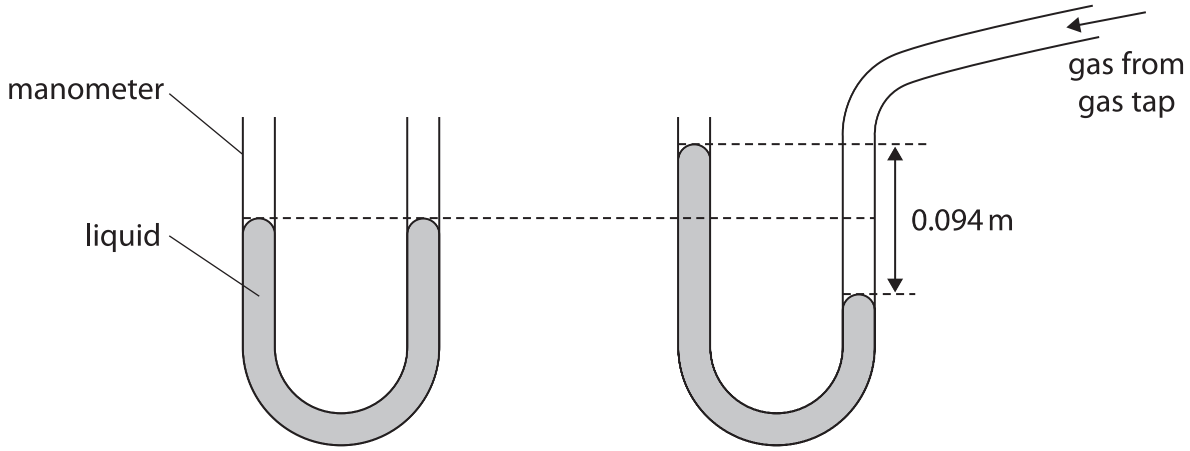
P = F / A

pressure = 6600 / 1300
pressure = 5.1 N/cm^2

pressure = 5.1 N/cm^2

5 A manometer is a device that can be used to measure the pressure difference between gas from a gas tap and the atmosphere.

When a gas tap is connected to the manometer, the liquid in the manometer moves due to the additional pressure of the gas.



(a) The pressure difference is linked to the difference in height of the two surfaces of the liquid by the formula

pressure difference = density × g × height difference

The height difference between the two surfaces is 0.094 m.

Calculate the pressure difference between the gas from the gas tap and the atmosphere.

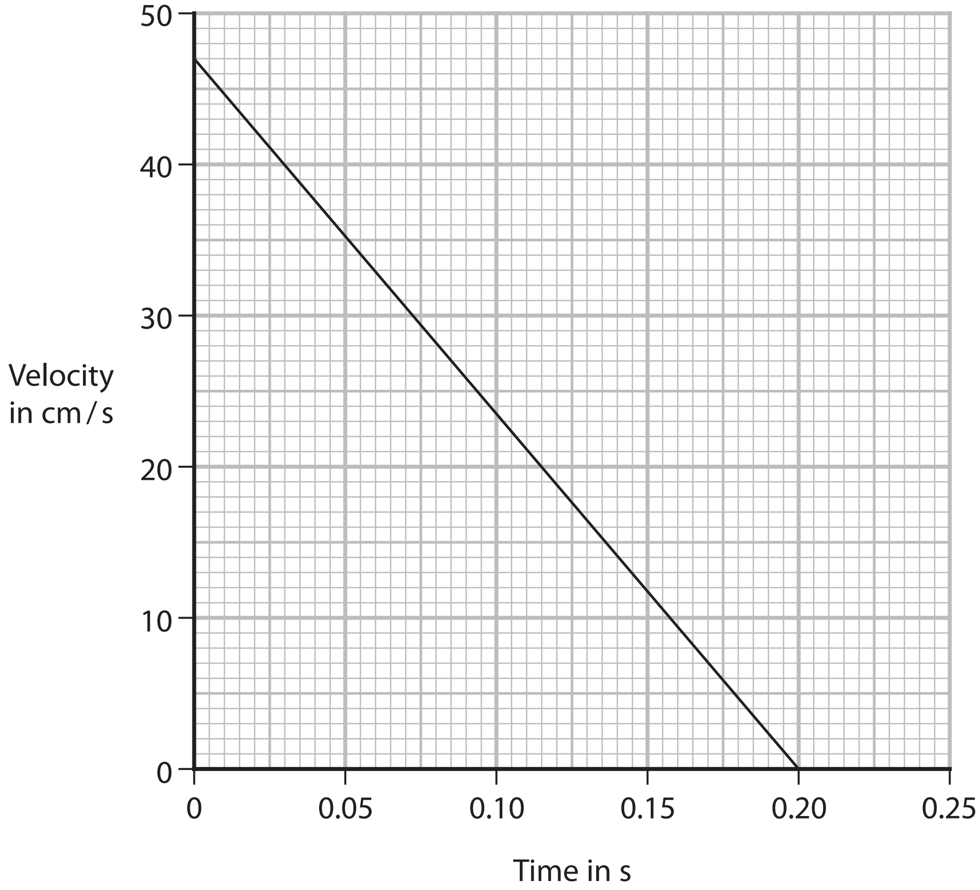
[for liquid, density = 14 000 kg / m^3]

(2)

pressure difference = 14 000 × 10 × 0.094
pressure difference = 13 000 Pa

pressure difference = 13 000 Pa

(b) The graph shows how the velocity of the surface of the liquid changes with time from when the gas tap is opened to when the water level stops moving.



(i) Use the graph to show that the distance travelled by the surface of the liquid is 4.7 cm.

(3)

Distance is area under graph.

Area=Area of the triangle = 0.5 x 0.2 x 47 = 4.7 cm

(ii) Calculate the acceleration of the surface of the liquid.

(3)

Acceleration = gradient

= 47/ 0. 2

= 235 cm/s^2

acceleration = ...235........ cm / s^2

(c) Explain how the gas pressure changes if the temperature of the gas increases.

You should use ideas about particles in your answer.

(3)

Temperature increases. Gas particles speeding up. KE of gas particles increases

More frequent collisions between gas particles and container.

Force on container increases. So gas pressure increases.

P 7 1 9 5 5 A 0 2 4 3 2

6 A student investigates how the time taken for a ball to roll down a slope changes with the distance from the bottom of the slope.

This is the student's method.

- place a ball on the slope 10 cm from the bottom of the slope
- release the ball and start a stopwatch
- stop the stopwatch when the ball arrives at the bottom of the slope
- record the time taken for the ball to roll down the slope
- repeat for different distances from the bottom of the slope

(a) Complete the table by placing a tick (✓) to show which variables are the independent, dependent and control variables in this investigation.

(4)

	Independent	**Dependent**	**Control**
Surface of slope			✓
Angle of slope			✓
Distance travelled	✓		
Time taken		✓	

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

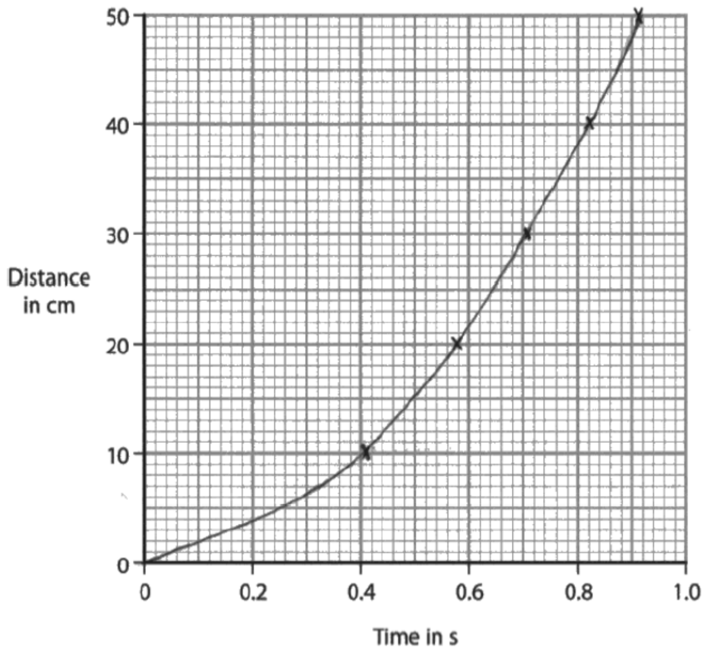
Distance travelled in cm	**Time taken in s**
10	0.41
20	0.58
30	0.71
40	0.82
50	0.91

(i) Plot the student's data on the grid.

(1)

(ii) Draw a best fit curve.

(1)



(iii) The student concludes that the results obey this relationship

$$\text{distance} \div (\text{time}^2) = \text{constant}$$

Use the student's data to deduce whether the student's results support this conclusion.

(4)

10 / (0.41x 0.41) = 59.49

20/ (0.58x 0.58) = 59.45

30/ (0.71x0.71) = 59.51

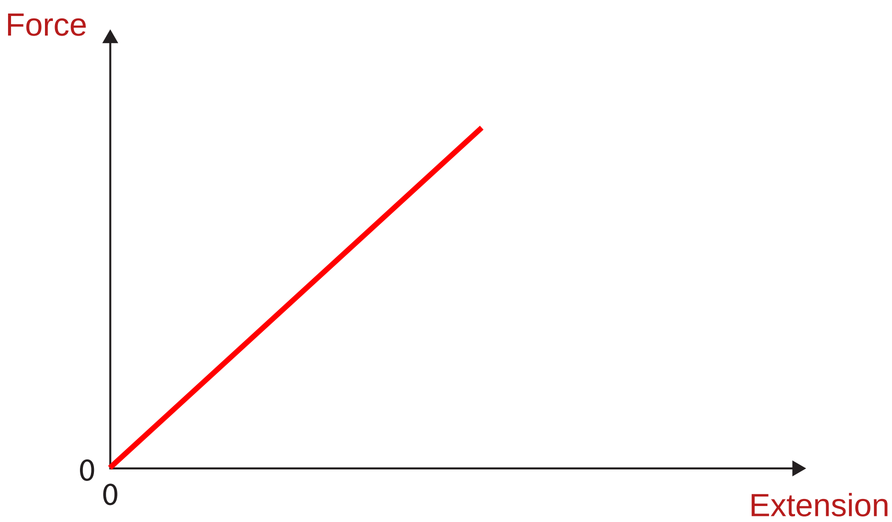
Yes. Constant is approximately similar. So Student's results support this conclusion.

7 (a) A metal spring obeys Hooke's law.

Sketch a graph to show that the spring obeys Hooke's law as it is stretched.

You should label both axes with appropriate physical quantities.

(3)



(b) Diagram 1 shows an object suspended from a support using a metal spring.

The object is initially at rest.

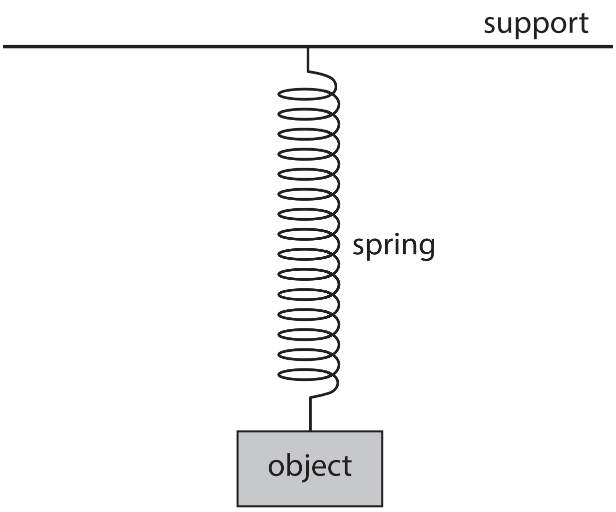


Diagram 1

(i) The object is pulled down and then released.

Diagram 2 shows the forces acting on the object at the instant it is released.

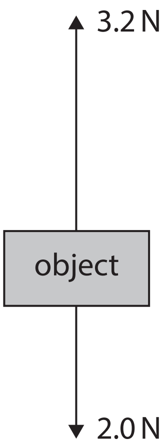


Diagram 2

Determine the magnitude and direction of the resultant force acting on the object.

(2)

3.2-2=1.2 N

magnitude of resultant force = 1.2 N

direction of resultant force = Upwards

(ii) The object has a mass of 0.20 kg.

Calculate the acceleration of the object at the instant it is released.

(3)

F = m x a
1.2 = 0.2 x a

a = 1.2/ 0.2 = 6 m/s²

acceleration = 6 m/s^2

(iii) Explain how the magnitude of the acceleration of the object changes, from the instant the object is released until the first time the object returns to its initial resting position.

You should refer to the forces acting on the object in your answer.

(3)

Acceleration decreases to zero

- spring extension decreases/spring becomes less stretched
- upwards force decreases.
- weight (of object) stays the same;
- resultant force decreases (to zero);

8 This question is about air pressure.

(a) During an aeroplane flight, a passenger drinks some water from a plastic bottle.

The passenger then replaces the top to seal the bottle, as shown in diagram 1.

Diagram 1

The air pressure outside the bottle is 80 kPa.

State the air pressure inside the bottle just after the bottle has been sealed.

(1)

air pressure = ...80...... kPa

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(b) As the aeroplane descends, the air pressure inside the aeroplane changes.

When the aeroplane lands, the passenger notices that the plastic bottle has collapsed, as shown in diagram 2.

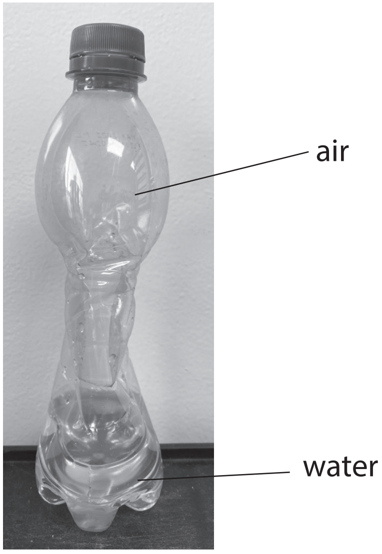


Diagram 2

Explain why the bottle has collapsed.

(2)

Pressure in aeroplane increases.

Decreasing volume in bottle increases pressure in bottle.

(c) Explain how gas molecules in the air exert a pressure on the surface of the bottle.

(3)

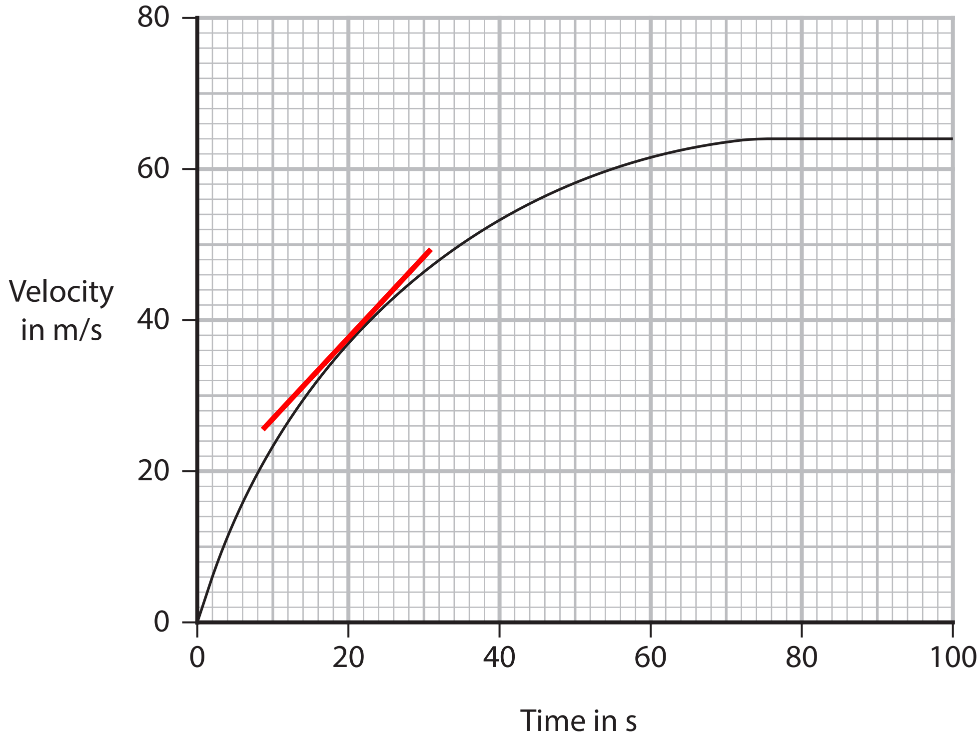
Direction of movement of molecules is random.

Molecules collide with the bottle surface exert a force on the surface.

Pressure is force on an area;

9 A car accelerates with a constant driving force along a horizontal road and reaches its maximum speed.

This is the velocity-time graph for the car's journey.



(a) By drawing a tangent to the curve, determine the acceleration of the car at a time of 20 s.

(4)

acceleration = gradient

acceleration in the range 1.05-1.15

acceleration = 1.12 m/s^2

(b) Determine the distance travelled by the car during the first 80 s of its journey.

(5)

distance = area under line

distance in the range = 3700-3800 m

distance = 3750 m

(c) Explain the motion of the car after 80 s.

(3)

Speed/velocity is constant.

driving force of car = air resistance

Forces are balanced

resultant force is zero

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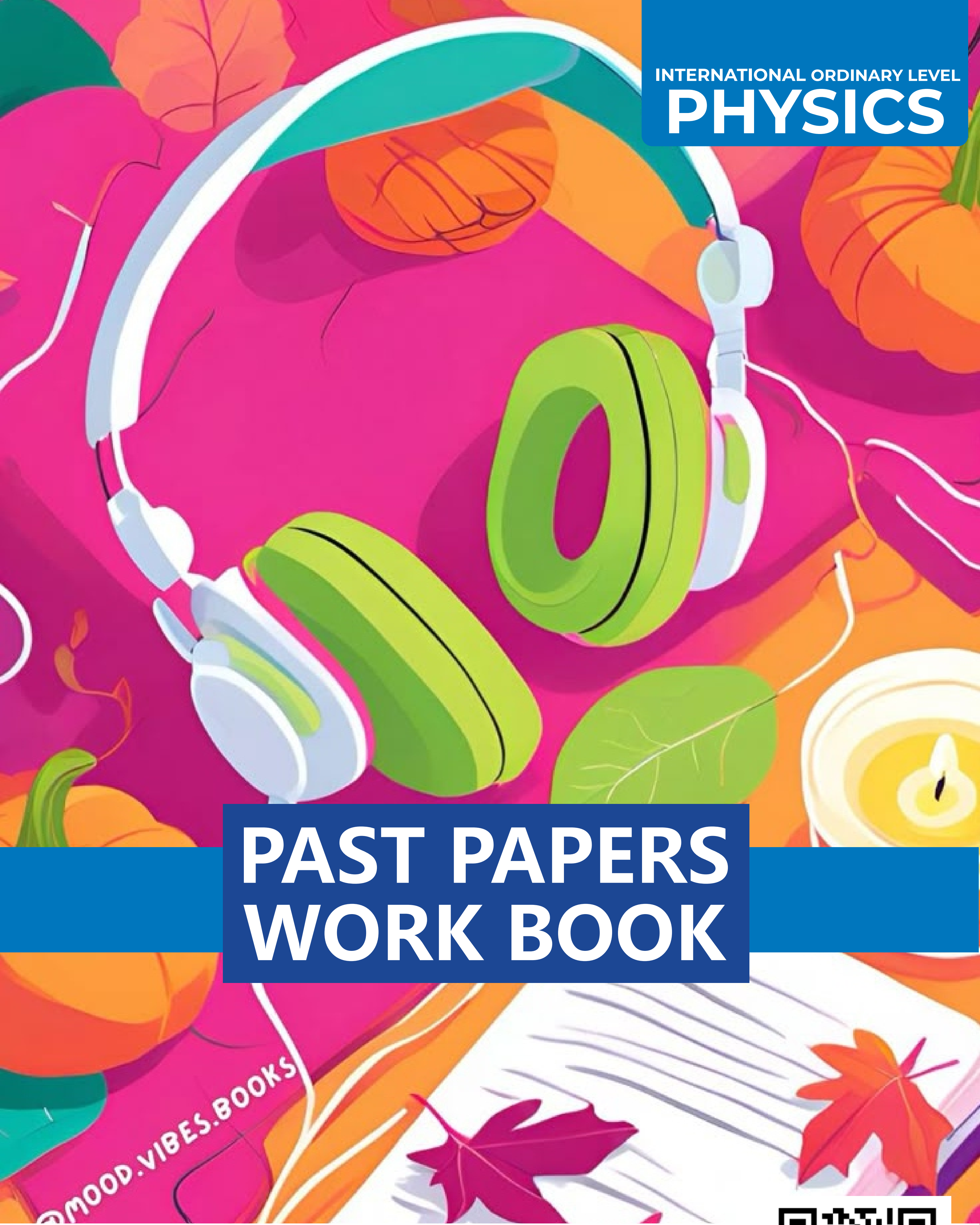
PHYSICS



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