UNIT 5 SOLIDS LIQUIDS AND GASES

Density and pressure

1.

(a) Photograph A shows a pile of identical metal squares on a table.

Photograph A

There are 6 metal squares in the pile.

The weight of each metal square is 0.072 N.

The pressure exerted on the table by the pile of metal squares is 820 Pa.

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

(1)

(ii) Calculate the area of the table in contact with the metal squares.

(3)

area = ... m^2

(b) Photograph B shows the 6 metal squares spread out on the table.

Photograph B

(i) Explain how spreading out the metal squares affects the pressure they exert on the table.

(2)

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(ii) Explain whether spreading out the metal squares affects the density of the material they are made from.

(2)

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2.

A student places a pile of coins on a table, as shown in photograph **A**.

Photograph **A**

There are 8 coins in the pile.

The weight of each coin is 0.036 N.

The area of each coin is 0.0013 m^2.

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

(1)

(ii) Calculate the pressure on the table caused by the pile of coins.

(2)

Pressure = ... Pa

(b) The student then spreads the 8 coins out on the table as shown in photograph **B**.

Photograph **B**

(i) Describe how this affects the total force from the coins on the table.

(2)

(i) Describe how this affects the total force from the coins on the table.

(2)

(ii) Explain how this affects the pressure on the table caused by the coins.

(2)

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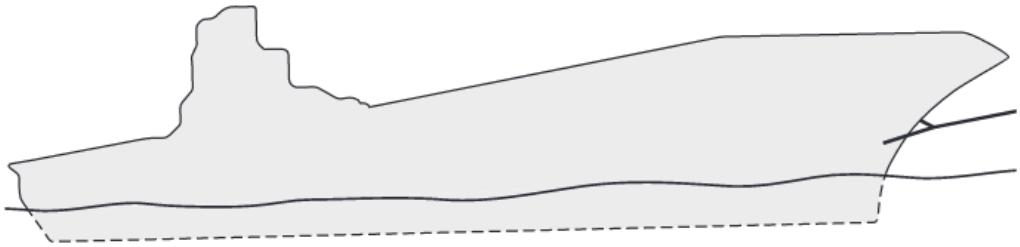
3.

A ship is taken out to sea before being intentionally sunk.



(a) The ship is floating on the water and is not moving.

Add two labelled arrows to the diagram to show the forces acting on the ship.

(2)

(b) The ship is then sunk.

It sinks to a depth of 48 m below the surface of the sea.

(i) State the equation linking pressure difference, height, density and *g*.

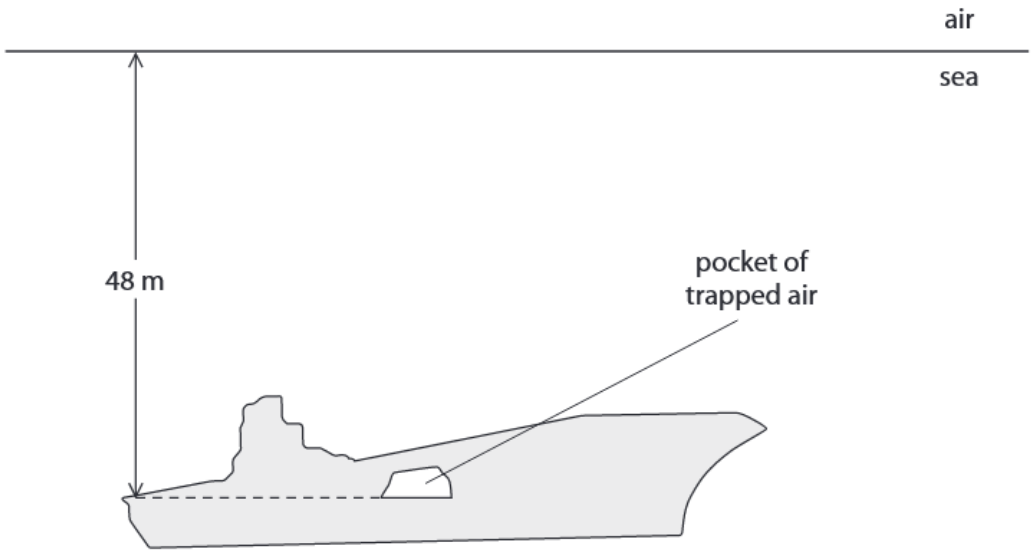
(1)

(ii) The density of sea water is 1030 kg/m^3.

Show that the pressure difference from the surface is about 500 kPa when the ship is at a depth of 48 m.

(2)

(c) A small pocket of air is trapped inside the ship as it sinks.



(i) Calculate the total pressure of the air at a depth of 48 m below the surface.

(1)

pressure = ... kPa

(ii) The volume of trapped air is 24 m^3 at the surface of the sea.

Calculate the volume of the trapped air at a depth of 48 m below the surface.

(3)

volume = ... m^3

Ideal gas molecules

4.

The photograph shows a cylinder of compressed air used to breathe underwater.

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(a) Explain how the air causes a pressure on the inside of the cylinder.

Refer to particles in your answer.

(3)

(b) Explain what happens to the pressure of the air inside the cylinder as its temperature increases.

(3)

(c) A fixed mass of air has a volume of 43 000 cm^3 when its pressure is 100 kPa.

Calculate the pressure of this fixed mass of air when it is inside the cylinder.

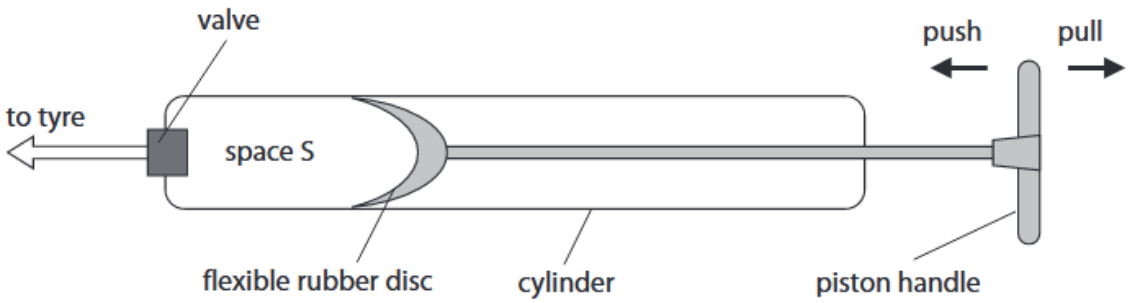
[volume of air in cylinder = 8500 cm^3]

(3)

pressure = ... kPa

5.

(a) The diagram shows the construction of a bicycle pump.



When the piston handle is pulled, air moves past the flexible rubber disc into space S.

When the piston handle is pushed, the flexible rubber disc presses against the sides of the cylinder so no air can pass the disc in either direction.

(i) When the volume of space S is 80 cm^3, the air in space S has a pressure of 1.01×10^5 Pa.

The valve is sealed so no air can escape from the pump.

Calculate the pressure inside space S when the piston handle is pushed in and the volume decreases to 10 cm^3.

(3)

pressure = ... Pa

(ii) State an assumption you have made about the air in space S.

(1)

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(iii) When the bicycle pump is used to inflate a tyre, the pump becomes hot.

Suggest why the pump becomes hot.

(2)

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6.

(a) Brownian motion provides evidence for particle theory.

(i) Give an example of how Brownian motion can be demonstrated.

(1)

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(ii) Explain how Brownian motion provides evidence for particle theory.

(3)

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(b) Using ideas about particles, explain how air inside a container exerts pressure.

(3)

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(c) A car tyre exerts a pressure of 193 kPa on the ground.

The contact area between the tyre and the ground is 0.013 m^2.

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

(1)

(ii) Calculate the force that the tyre exerts on the ground.

(3)

force = ... N

(iii) The air in the tyre heats up when the car is driven.

Explain how this affects the contact area between the tyre and the ground.
[assume the volume of the air in the tyre remains constant]

(3)

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