www.megalecture.com · www.youtube.com/@megalecture

Online tutoring for Cambridge IGCSE, O Level & A Level Physics

IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Pressure

Paper 2 — Theory / Structured Questions (topical compilation)

Fahad H. Ahmad

Contact: +92 323 509 4443

M.Eng NUS Singapore · B.Eng NUST · 15+ years of teaching experience in Singapore, UAE & Pakistan · 60,000+ subscribers and 20 million+ video lecture views.

Fahad H. Ahmad
+92 323 509 4443

Pressure

Question # 1: May June 2003/P2/Q2

Fig. 2.1 shows a manometer used to measure the pressure difference between the air inside a plastic container and the atmosphere outside.

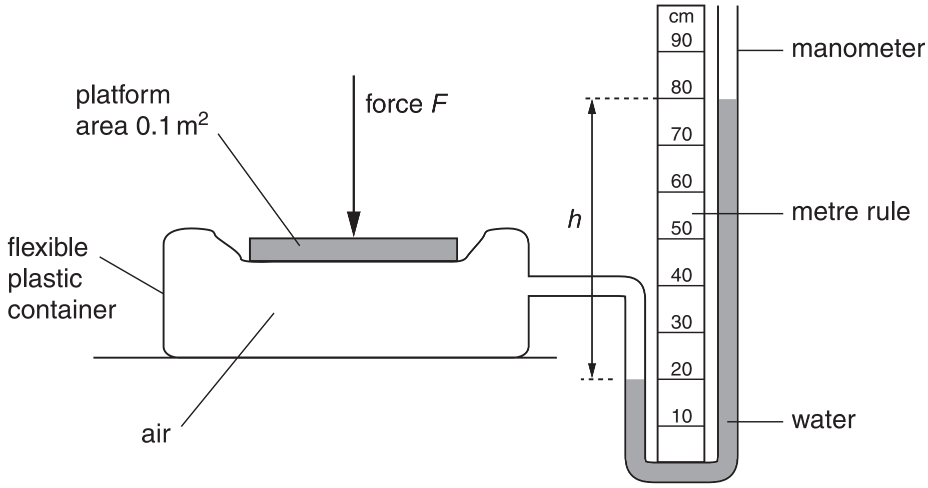


Fig. 2.1

A pressure difference of 100 Pa causes a one centimetre difference in water levels.

(a) Using Fig. 2.1, determine the pressure difference in Pa shown by the manometer.

pressure difference = ...Pa [1]

(b) State what changes, if any, occur to the distance *h* in Fig. 2.1 if

(i) the manometer tube is narrower,

....

(ii) a liquid denser than water is used in the manometer.

....

[2]

(c) The pressure difference measured by the manometer is caused by the force *F*. This force is the weight of a student standing on the platform. The cross-sectional area of the platform is 0.1 m^2.

(i) State the formula that relates pressure, force and area.

....

(ii) Calculate the weight of the student.

weight = ...

[3]

Question # 2: May June 2005/P2/Q3

Fig. 3.1 shows a weather balloon. The balloon is shown partly filled with gas from a cylinder.

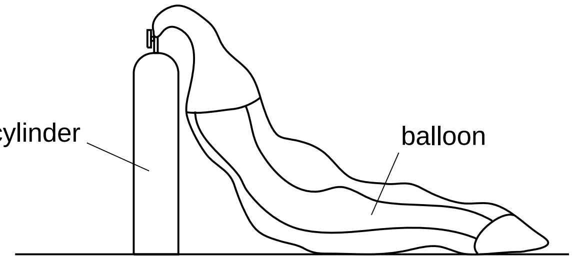


Fig. 3.1

The balloon contains no gas initially. When it is connected to the cylinder, gas enters the balloon. The pressure in the cylinder decreases.

(a) Explain why the molecules inside the cylinder

(i) exert a large pressure initially,

....

....

.... [2]

(ii) exert a smaller pressure in the cylinder when the balloon is filled.

....

....

.... [1]

(b) The volume of the cylinder is 0.0020 m^3. The pressure inside the cylinder is initially 200 atmospheres. When the cylinder is connected to the balloon, the final pressure in the cylinder and the balloon is 1.0 atmosphere.

The temperature of the gas remains constant.

Calculate the final volume of gas in the balloon. State the equation that you use.

volume = ... [3]

Question # 3: May June 2008/P2/Q2

Fig. 2.1 shows a device for punching holes in a piece of paper. A person applies a force *F* at the end of the arm. Just before the hole is made in the paper, the arm is at rest.

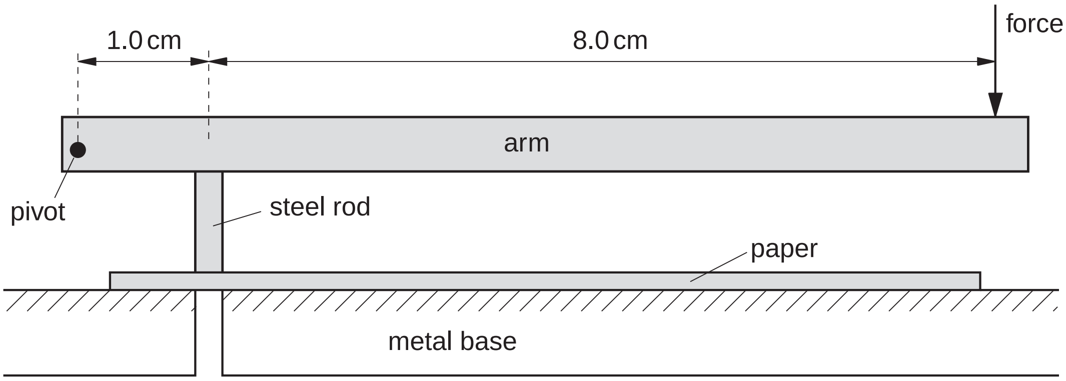


Fig. 2.1

(a) Just before the hole is made, the force upwards on the steel rod is 7.2 N.

Calculate the value of *F*. Use the distances marked on Fig. 2.1.

F = ... [2]

(b) The steel rod pushes the paper into the hole in the metal base with a force of 7.2 N. The end of the steel rod has an area of $2.8 \times 10^{-5}\,\text{m}^2$.

Calculate the pressure exerted on the paper.
State the formula that you use in your calculation.

pressure = ... [2]

(c) The force downwards on the paper due to the rod and the force upwards on the rod due to the paper are related by Newton's third law. State Newton's third law.

....

....

.... [1]

Question # 4: May June 2011/P22/Q3

(a) Explain, using ideas about molecules,

(i) why a balloon filled with gas expands when heated,

....

....

....

....[2]

(ii) why a balloon filled with water expands very little when heated.

....

....[1]

(b) **(i)** A bubble of gas rises from the bottom of a lake to the surface. The pressure at the bottom of the lake is 3.0×10^5 Pa and the pressure at the surface is 1.0×10^5 Pa. The volume of the bubble at the bottom of the lake is $2.0\,cm^3$.

Calculate the volume of the bubble at the surface.

volume = ...[2]

(ii) State one assumption that you have made in your calculation in **(i)**.

....

....[1]

Question # 5: May June 2012/P21/Q3

A student measures the pressure inside a bicycle tyre using a pressure gauge he has constructed. Fig. 3.1 shows the apparatus he uses. The piston and rod move along the smooth cylindrical tube.

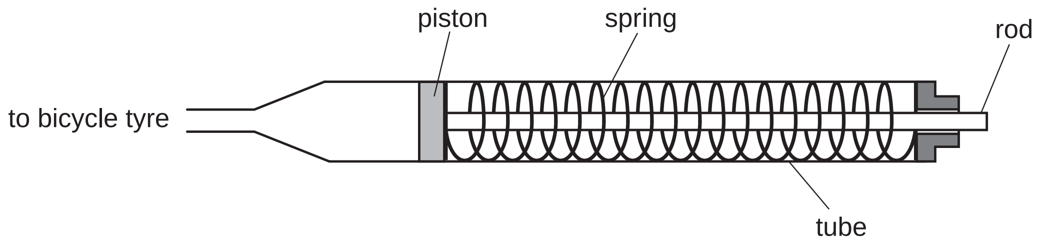


Fig. 3.1

The change in length of the spring is proportional to the force applied to the spring. A force of 2.8 N compresses the spring by 2.0 cm.

The student connects the pressure gauge to the tyre. Air from the tyre exerts a force on the piston. As the piston moves, the spring is compressed. The piston moves 10 cm to the right and then stops.

(a) Calculate the force exerted on the piston by the spring.

force = ...[1]

(b) The cross-sectional area of the piston is $3.0 \times 10^{-5}\,\text{m}^2$. Calculate the pressure of the air inside the tyre.

pressure = ...[2]

(c) Suggest one change to the apparatus so that the piston moves a smaller distance when measuring the same pressure.

....[1]

(d) Each time that the pressure gauge is used, the pressure in the tyre falls slightly. The temperature stays constant. Describe, using ideas about molecules, why the pressure falls.

....

....

....

....[2]

Question # 6: May June 2013/P21/Q3

Fig. 3.1 shows a glass tube dipped into mercury. A vacuum pump is connected to the top of the tube and switched on. The mercury rises up the tube and stops.

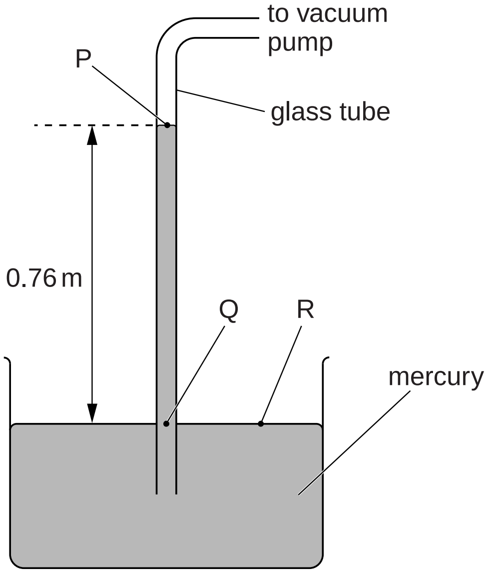


Fig. 3.1

(a) Three points on Fig. 3.1 are labelled P, Q and R.

State which **two** of these points are at atmospheric pressure.

.... [1]

(b) The density of mercury is 13 600 kg / m^3 and the gravitational field strength *g* is 10 N / kg.

Calculate the pressure due to the column of mercury of length 0.76 m.

pressure = ... [2]

(c) State and explain what happens if the mercury in the apparatus shown in Fig. 3.1 is replaced with water.

....

....

.... [2]

Question # 7: May June 2015/P21/Q3

An experiment is carried out to find how the pressure of a fixed mass of air at room temperature varies with volume. Fig. 3.1 shows the apparatus used. The syringe is sealed at one end and the piston is free to move up and down as different metal weights are used.

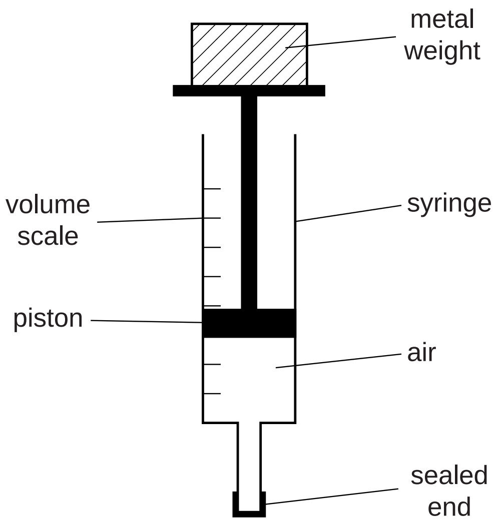


Fig. 3.1

(a) State the unit in which pressure is measured.

....[1]

(b) Fig. 3.2 shows the axes for a graph of pressure against volume for the air in the syringe.

One point is plotted on the graph at pressure of P_0 and volume V_0.

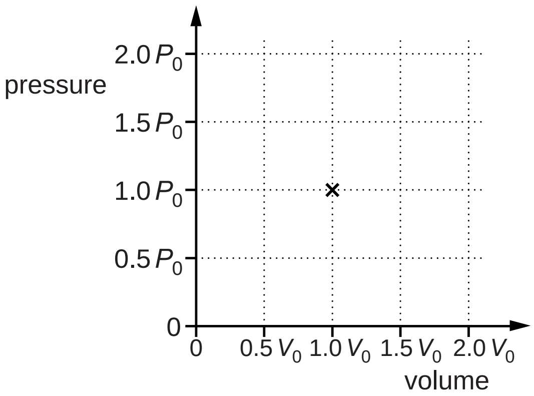


Fig. 3.2

The temperature of the air is kept constant.

On Fig. 3.2,

(i) plot points at volumes of 0.5 V_0 and 2.0 V_0, [1]

(ii) complete the graph. [1]

(c) More metal weights are placed on top of the syringe.

Explain how the molecules of air inside the syringe are able to support more metal weights.

....

....

....

....

....

....

....[3]

Question # 8: May June 2015/P22/Q2

Fig. 2.1 shows two engineers measuring the length of a wall made from concrete.

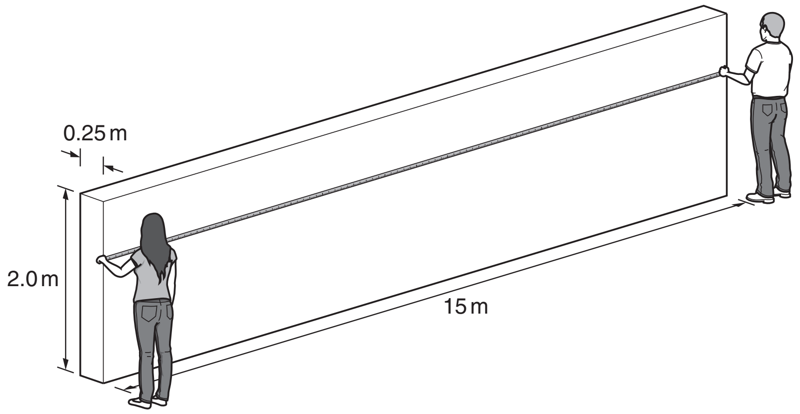


Fig. 2.1 (not to scale)

The wall is 2.0 m high, 15 m long and 0.25 m thick.

The weight of the wall is 180 000 N and the mass of the wall is 18 000 kg.

(a) The engineers measure the length of the wall in one single measurement.

State the name of the measuring instrument they use.

.... [1]

(b) The engineers state that the density of the concrete affects the pressure exerted by the wall on the ground but that the length of the wall does not affect this pressure.

(i) Define *density*.

....

.... [1]

(ii) Calculate the density of the concrete.

density = ... [2]

(iii) Calculate the pressure exerted by the wall on the ground.

pressure = ... [2]

(iv) Without further calculation, explain why doubling the length of the wall does not change the pressure that the wall exerts on the ground.

....

....

....

.... [1]

Question # 9: May June 2017/P21/Q2

Fig. 2.1 shows a student sitting on a chair. Fig. 2.2 shows the same student with his chair tilted backwards slightly.

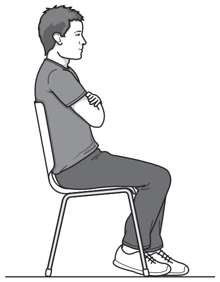


Fig. 2.1

Fig. 2.2

(a) State and explain how the pressure of the chair on the floor differs in the two positions.

....

....

....

....[2]

(b) The chair and student fall over if the chair is tilted backwards more than in Fig. 2.2.

Explain why.

....

....

....

....

....[2]

Question # 10: May June 2017/P22/Q3

Fig. 3.1 shows the brake pedal of a car which is connected to a brake cylinder.

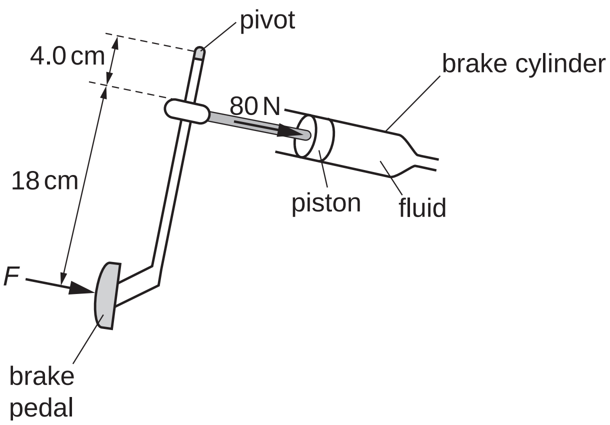


Fig. 3.1 (not to scale)

The brake is pressed with a force *F*. This force produces a moment about the pivot.

Pressing the brake causes a force of 80 N to act on the piston.

(a) Define the term *moment*.

....

....[2]

(b) Calculate the force *F* applied to the brake pedal.

F = ...[2]

(c) The cross-sectional area of the piston is 0.0012 m^2.

Calculate the pressure exerted by the brake piston on the fluid.

pressure = ...[2]

Question # 11: May June 2018/P21/Q3

A passenger in an aircraft closes a plastic bag with some air inside, as shown in Fig. 3.1.

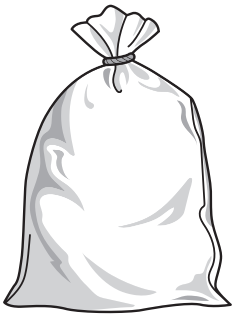


Fig. 3.1

(a) Explain how the molecules of air in the bag exert a pressure on the inside of the bag.

....

....

....

....

....[2]

(b) When the bag is closed, the pressure of the air inside the aircraft is 80 kPa and the bag contains 500 cm^3 of air.

(i) When the aircraft is on the ground, the pressure of the air inside the aircraft is 100 kPa.

Calculate the volume of air inside the bag when the aircraft is on the ground.

volume = ...[2]

(ii) State two assumptions that you made in your calculation in **(b)(i)**.

1. ....

....

2. ....

....

[2]

Question # 12: Oct Nov 2003/P2/Q5

A thin-walled plastic bottle is sealed and contains dry air at atmospheric pressure.

(a) Explain how the molecules of air inside the bottle exert a pressure on the walls.

....

....

....

....

.... [2]

(b) Ice is placed inside the bottle, and the bottle is then sealed again. The temperature of the air inside the bottle falls and the bottle becomes partially crushed. Explain, in terms of the molecules of air inside and outside the bottle, why this happens.

....

....

....

....

....

.... [4]

Question # 13: Oct Nov 2004/P2/Q2

Fig. 2.1 shows a water manometer used to measure the pressure inside a gas pipe.

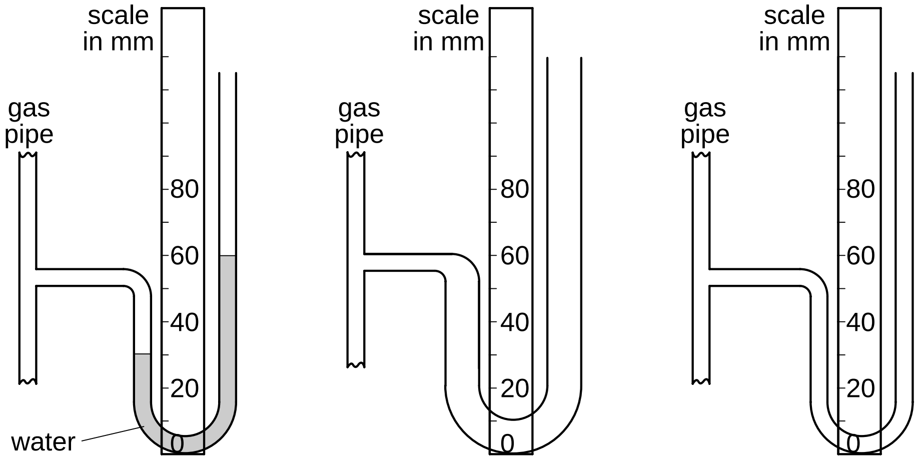


Fig. 2.1 **Fig. 2.2** **Fig. 2.3**

(a) State whether the pressure inside the gas pipe in Fig. 2.1 is larger than or smaller than atmospheric pressure.

....[1]

(b) The manometers shown in Figs. 2.2 and 2.3 are connected to the same gas pipe at the same pressure as shown in Fig. 2.1.

On Figs. 2.2 and 2.3, draw the levels of the liquid in each manometer if

(i) the manometer in Fig. 2.2 contains water and has tubes with twice the diameter of Fig. 2.1,

(ii) the manometer in Fig. 2.3 contains a liquid with density half that of water.

[2]

(c) The manometer shown in Fig. 2.4 has its top end sealed.

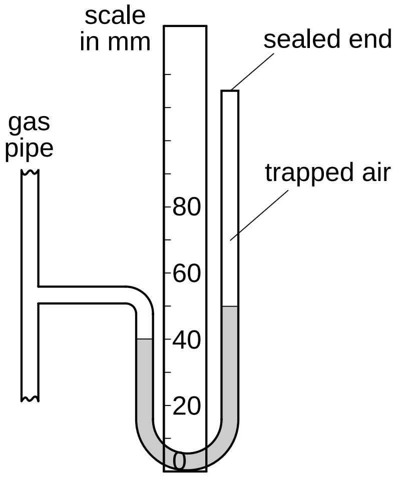


Fig. 2.4

Explain why the water levels are different in Figs. 2.4 and 2.1, even though the pressure in the gas pipe is the same.

....

....

....

....[2]

Question # 14: Oct Nov 2005/P2/Q2

Fig. 2.1 shows a stationary piston in a cylinder.

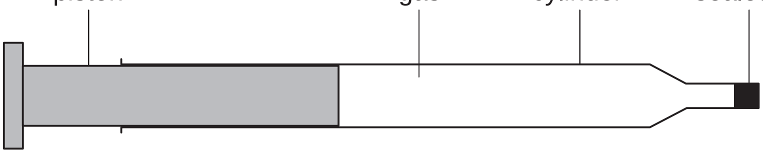


Fig. 2.1

(a) The gas in the cylinder exerts the same pressure on the piston as it does on the sealed end. The sealed end has a smaller cross-sectional area.

Use ideas about molecules to explain why the pressures are the same.

....

....

....

....

.... [2]

(b) The piston is pushed inwards and the temperature of the gas stays constant.

(i) The piston moves 0.10 m. The average force exerted on the piston to compress the gas is 23 N.

Calculate the work done. State the formula that you use.

work done = ... [2]

(ii) The gas in the cylinder starts at a pressure of 1.0×10^5 Pa and has a volume of 100 cm^3. The volume of the gas decreases to 80 cm^3.

Calculate the final pressure of the gas. State the formula that you use.

pressure = ... [3]

Question # 15: Oct Nov 2009/P2/Q1

A diver holds his breath and dives into the sea from a boat to a depth of 25.0 m. The atmospheric pressure is 1.05×10^5 Pa.

(a) **(i)** Explain why the pressure at this depth is greater than the atmospheric pressure.

....

....[1]

(ii) Other than the depth and the atmospheric pressure, state **one** quantity that affects the pressure in a liquid.

....

....[1]

(b) **(i)** The pressure due to 25.0 m of sea-water is 2.55×10^5 Pa. Calculate the total pressure at this depth.

pressure = ...[1]

(ii) As the diver holds his breath and descends to a depth of 25.0 m, the greater pressure causes the volume of the air trapped in his lungs to change.

When he is on the boat, the total volume of the air in his lungs is 6000 cm^3. Calculate the volume of this air at a depth of 25.0 m.

volume = ...[2]

Question # 16: Oct Nov 2010/P22/Q2

A U-shaped tube, of constant cross-sectional area, contains some water of density $1000\,kg/m^3$. Oil that does not mix with water is then poured into the right-hand side of the tube. Fig. 2.1 shows the levels of the water and the oil when equilibrium is reached.

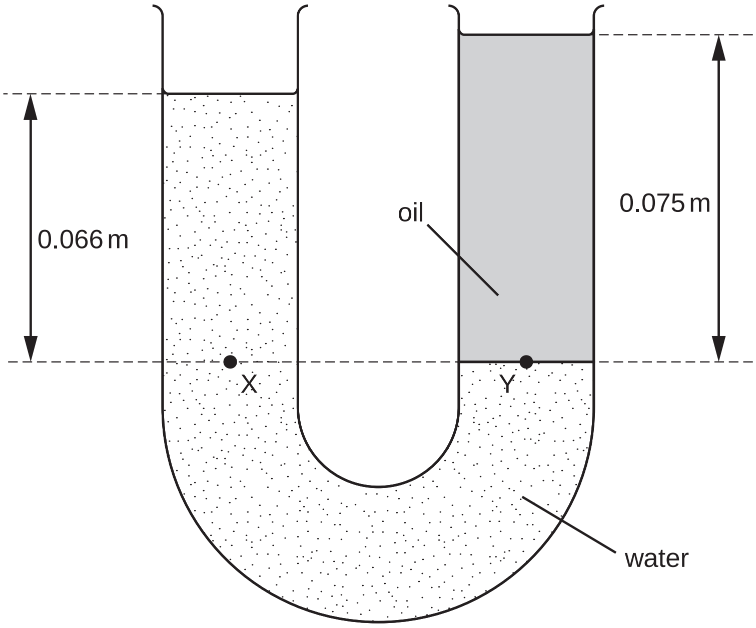


Fig. 2.1

Points X and Y are at the same horizontal level. X is 0.066 m below the top surface of the water. Y is 0.075 m below the top surface of the oil.

(a) State two quantities that influence the pressure beneath the surface of a liquid.

1. ....

2. ....
[2]

(b) The cross-sectional area of the tube is $5.0 \times 10^{-4}\,m^2$.

(i) Calculate the mass of water above the level of X.

mass = ... [2]

(ii) The pressure caused by 0.066 m of water at X is equal to that caused by 0.075 m of the oil at Y.

Determine the density of the oil.

density = ... [2]

Question # 17: Oct Nov 2011/P22/Q3

A helium balloon carries scientific instruments high up in the atmosphere.

Fig. 3.1 shows the partially inflated helium balloon leaving the ground.

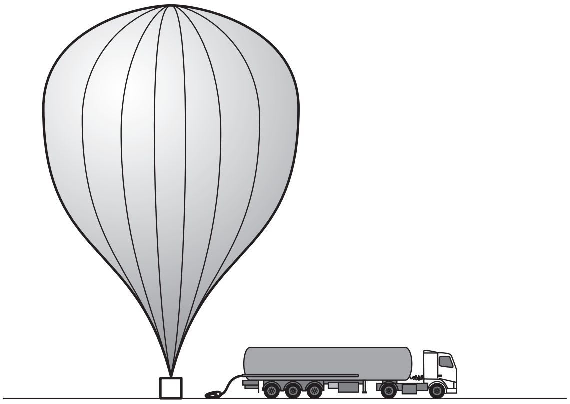


Fig. 3.1

(a) A completely deflated balloon contains no gas. The helium to inflate it is stored in a very large cylinder at a pressure p_1 of 2.5×10^7 Pa. Helium that occupies a volume V_1 of 18 m^3 in the cylinder is slowly released into the balloon until the pressure p_2 in the balloon is 1.0×10^5 Pa. The temperature of the helium remains constant.

(i) State the equation that relates the volume V_2 of the helium in the balloon at launch to p_1, p_2 and V_1.

....[1]

(ii) Calculate V_2.

V_2 = ...[2]

(b) When it leaves the ground, the balloon is only partially inflated. Suggest and explain why this is necessary.

....

....

....[2]

Question # 18: Oct Nov 2012/P22/Q4

Fig. 4.1 shows gas trapped in a cylinder by a piston.

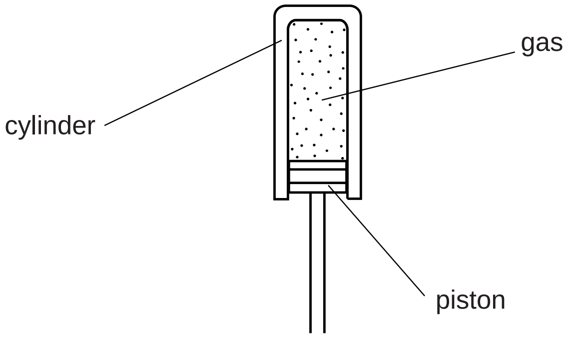


Fig. 4.1

The piston has a cross-sectional area of $0.0050\,\text{m}^2$. It moves upwards, through a distance of 0.074 m, compressing the gas. During this compression, the average pressure of the gas is 4.6×10^5 Pa.

(a) Calculate

(i) the average force exerted on the piston by the gas during compression,

force = ... [2]

(ii) the work done on the gas during compression.

work done = ... [2]

(b) The gas in the cylinder has a heat capacity of 0.27 J / °C and heats up as it is compressed.

(i) Calculate the maximum possible temperature rise of the gas.

temperature rise = ... [2]

(ii) Suggest a reason why the actual temperature rise of the gas is less than the value calculated in **(i)**.

....

.... [1]

Question # 19: Oct Nov 2013/P21/Q3

A schoolboy tries to inflate a bicycle tyre using a bicycle pump.

(a) Explain how the air molecules inside the pump produce a pressure.

....

....

.... [2]

(b) The opening at the end of the pump is blocked with a small amount of dried earth, as shown in Fig. 3.1.

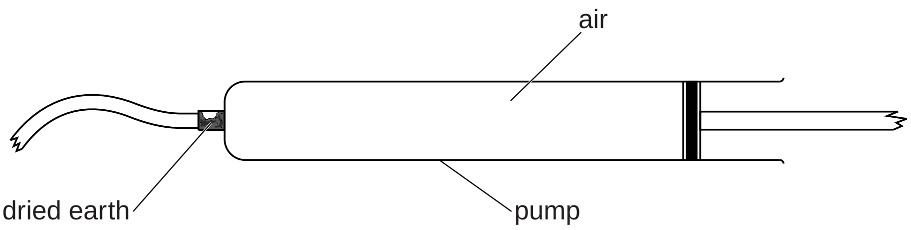


Fig. 3.1

The air is initially at a pressure of 100 kPa. During one stroke of the pump, the volume of air in the pump is reduced from 120 cm^3 to 16 cm^3.

(i) Assuming that the temperature of the air remains constant, calculate the pressure of the compressed air.

pressure = ... [2]

(ii) Compressed air in the pump at this pressure exerts a force on the dried earth. The cross-sectional area of the opening at the end of the pump is $1.2 \times 10^{-5}\,m^2$.

Calculate the size of this force.

force = ... [2]

(iii) In fact, the temperature of the air in the pump increases as its volume decreases.

The actual pressure of the 16 cm^3 of air differs from the pressure calculated in **(i)**.

Using ideas about molecules, state and explain this difference.

....

....

....

.... [3]

Question # 20: Oct Nov 2013/P22/Q3

A farmer uses a hydraulic system to operate machinery that is pulled behind a tractor.

Two cylinders and the flexible pipe that joins them contain oil. Two pistons keep the oil in the cylinders. The arrangement is shown in Fig. 3.1.

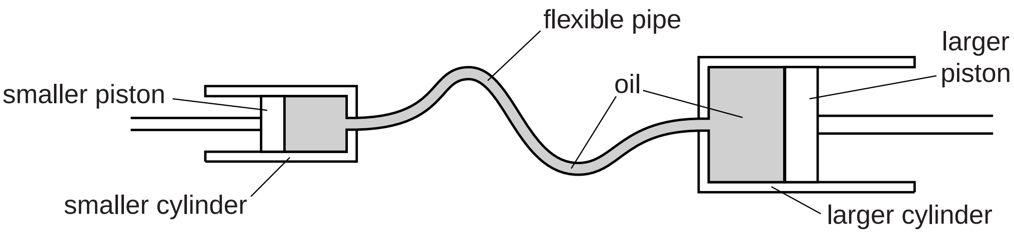


Fig. 3.1

The cross-sectional area of the smaller cylinder is 0.048 m^2.
The cross-sectional area of the larger cylinder is 0.14 m^2.

The smaller piston exerts a force of 12 000 N on the oil.

(a) Calculate

(i) the pressure in the oil,

pressure = ... [2]

(ii) the force exerted by the oil on the larger piston.

force = ... [1]

(b) Suggest why the resultant force on the larger piston is less than the value obtained in **(a)(ii)**.

....

.... [1]

(c) The smaller piston moves a distance of 0.065 m into the cylinder.

Calculate the work done on the oil by the smaller piston.

work done = ... [2]

(d) Suggest one advantage of using oil rather than air in the system.

.... [1]

Question # 21: Oct Nov 2014/P21/Q3

Before a small, inflatable boat is used, air is pumped into its rubber chamber.

Fig. 3.1 shows a man using an air pump to inflate the boat.

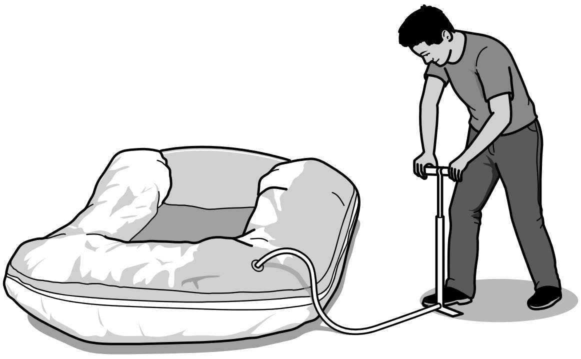


Fig. 3.1

Before the man starts to use the pump, the air in the vertical cylinder of the pump is at atmospheric pressure.

(a) Explain, in terms of molecules, how the air inside the cylinder exerts a pressure.

....

....

....

....[3]

(b) When the boat is fully inflated, a valve is closed trapping the air in the rubber chamber. The air pump is disconnected.

The man sits on the side of the boat. The volume of the rubber chamber decreases and the pressure of the air in the rubber chamber increases. The temperature of the air stays constant.

Explain, in terms of molecules, why the pressure increases.

....

....

....[2]

Question # 22: Oct Nov 2014/P22/Q3

Fig. 3.1 shows a helium cylinder being used at a funfair to inflate balloons that float in the air.

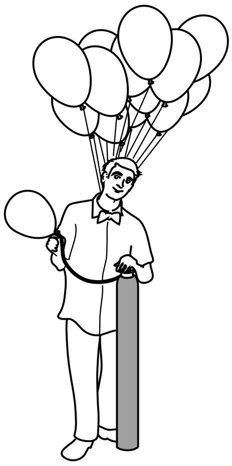


Fig. 3.1

Initially, all the helium is stored in the cylinder at a pressure of 2.0×10^7 Pa.

When no more balloons can be filled, all the helium occupies a total volume of $1.8\,m^3$ and is at a pressure of 1.0×10^5 Pa. The temperature of the helium has not changed.

(a) Calculate, stating the formula used, the initial volume of the helium in the cylinder.

volume = ...[3]

(b) The balloon seller takes the cylinder back to the helium supplier and it is refilled. The mass of helium in the cylinder is 0.30 kg.

(i) Calculate the density of helium in the cylinder.

density = ...[2]

(ii) The mass of the empty cylinder is 16 kg.

Suggest why weighing the cylinder is not an accurate method of determining the amount of helium supplied.

....

....[1]

Question # 23: Oct Nov 2015/P21/Q2

Fig. 2.1 shows a freezer for keeping food frozen.

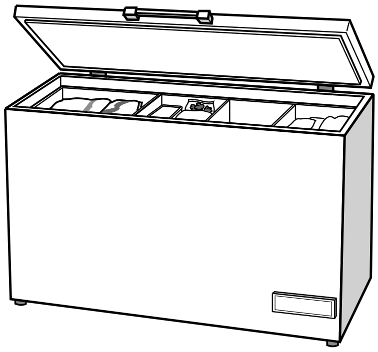


Fig. 2.1

(a) The outside surface of a freezer is painted white.

Explain one advantage of having the outside surface of the freezer painted white.

....

....

.... [2]

(b) **(i)** The lid of the freezer is closed and air at room temperature is trapped inside the freezer. The freezer is switched on.

State and explain, using ideas about molecules, what happens to the pressure of the air in the freezer, as it cools.

....

....

....

....

.... [3]

(ii) When the freezer reaches its operating temperature, it is more difficult to open the lid.

Explain why.

....

....

.... [1]

Question # 24: Oct Nov 2015/P22/Q3

A very deep tank is used when training sailors to escape from submarines. The tank is cylindrical and open to the air at the top. Fig. 3.1 shows the tank.

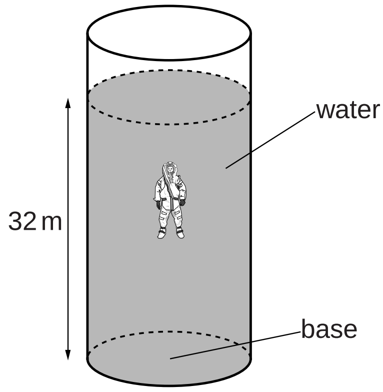


Fig. 3.1 (not to scale)

The area of the base of the tank is 45 m^2 and the tank is filled with water to a depth of 32 m.

(a) The density of water is 1000 kg / m^3 and the gravitational field strength *g* is 10 N / kg.

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

pressure = ... [2]

(b) The pressure in the water at the base of the tank is 4.2×10^5 Pa.

(i) Explain why the pressure in the water at the base of the tank differs from the value calculated in **(a)**.

....

....

.... [1]

(ii) Calculate the force exerted on the base of the tank.

force = ... [2]

(c) Force is a vector quantity and pressure is a scalar quantity.

State how a vector quantity differs from a scalar quantity.

....

.... [1]

Question # 25: Oct Nov 2015/P22/Q6

A gas is trapped at atmospheric pressure in a cylinder by a piston. The piston is held in a fixed position by a movable rod. Fig. 6.1 shows the cylinder.

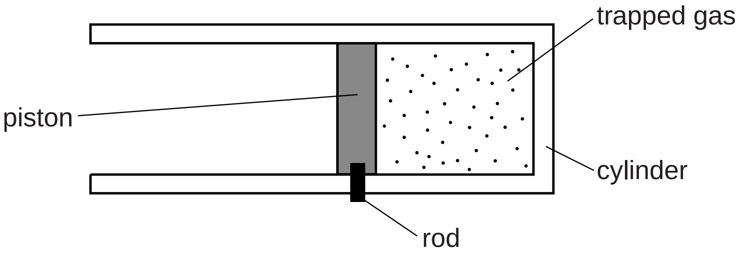


Fig. 6.1

The cylinder is heated. As the temperature of the gas increases, its pressure increases.

(a) Explain, in terms of molecules, why the pressure of the trapped gas increases.

....

....

....

.... [2]

(b) The rod is pulled down and the piston is then free to move as shown in Fig. 6.2.

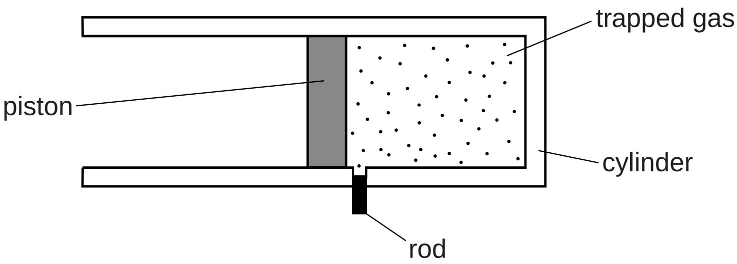


Fig. 6.2

As the piston moves, the temperature of the gas remains constant.

State and explain, in terms of molecules, what happens to the pressure of the gas.

....

....

....

....

....

.... [3]

Question # 26: Oct Nov 2017/P21/Q2

Fig. 2.1 shows a can of compressed air that is being used to blow dust off a computer keyboard.

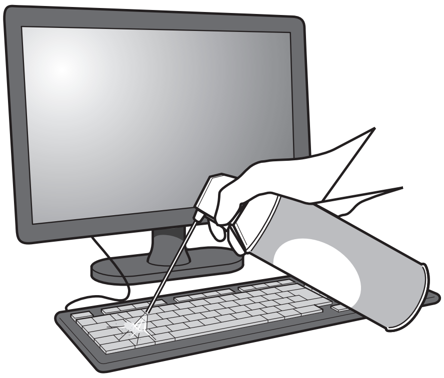


Fig. 2.1

(a) The pressure of the air inside the can is greater than the pressure of the atmosphere.

(i) State what is meant by the term *pressure*.

....

.... [1]

(ii) Explain, in terms of molecules, why the pressure of the air inside the can decreases as it is used.

....

....

....

....

....

.... [3]

(b) A student uses an inverted measuring cylinder in a water trough to measure the volume that the air occupies at atmospheric pressure. Fig. 2.2 shows the equipment.

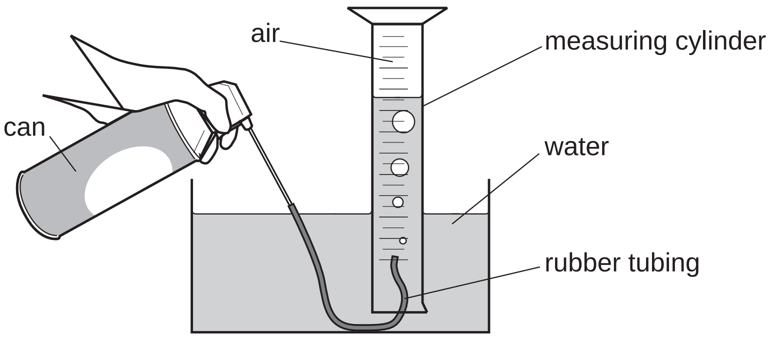


Fig. 2.2 (not to scale)

Initially the inverted measuring cylinder is full of water.

The student presses the top of the can and air passes through the rubber tubing into the inverted measuring cylinder. The air gradually replaces the water in the cylinder until no more air can leave the can. The final temperature of the air is equal to its initial temperature.

The volume of the air inside the can is $1.8 \times 10^{-4}\,m^3$.

The student observes that, at an atmospheric pressure of $1.0 \times 10^5\,Pa$, the total volume of the air in the measuring cylinder, the can and the tubing is now $9.4 \times 10^{-4}\,m^3$.

Determine the original pressure of the air in the can.

pressure = ... [2]

Question # 27: Oct Nov 2017/P22/Q3

A solid, rectangular concrete block is lying horizontally on flat ground with one of its largest sides in contact with the ground. Fig. 3.1 shows the dimensions of the block.

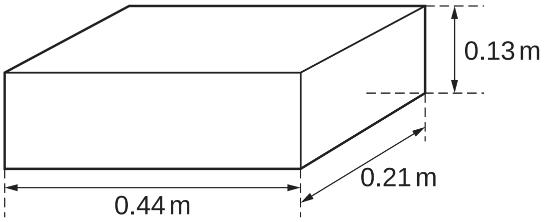


Fig. 3.1

The weight of the block is 240 N.

(a) Calculate the pressure on the ground caused by the block.

pressure = ...[2]

(b) State why the total pressure on the ground underneath the block is larger than the value obtained in **(a)**.

....

....[1]

(c) The block is of uniform density.

(i) State the height of the centre of mass of the block above the ground.

height = ...[1]

(ii) The block is rotated about its lower, left-hand edge so that it comes to rest on one of its smallest sides.

This is shown in Fig. 3.2.

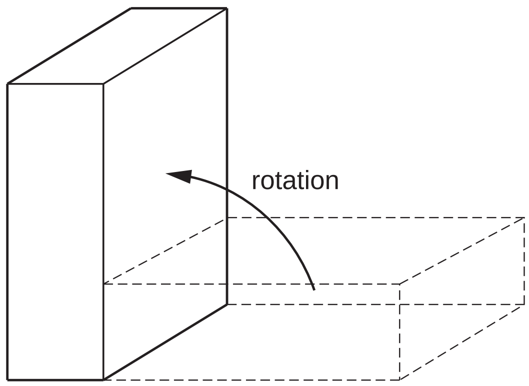


Fig. 3.2

Explain why work is done as the block is rotated.

....

....

....

....[2]

Question # 28: Oct Nov 2018/P21/Q2

A small crack appears in an oil tank and a stream of oil is pushed out through the crack. The oil hits the floor at P where a puddle of oil starts to form.

Fig. 2.1 shows the oil tank.

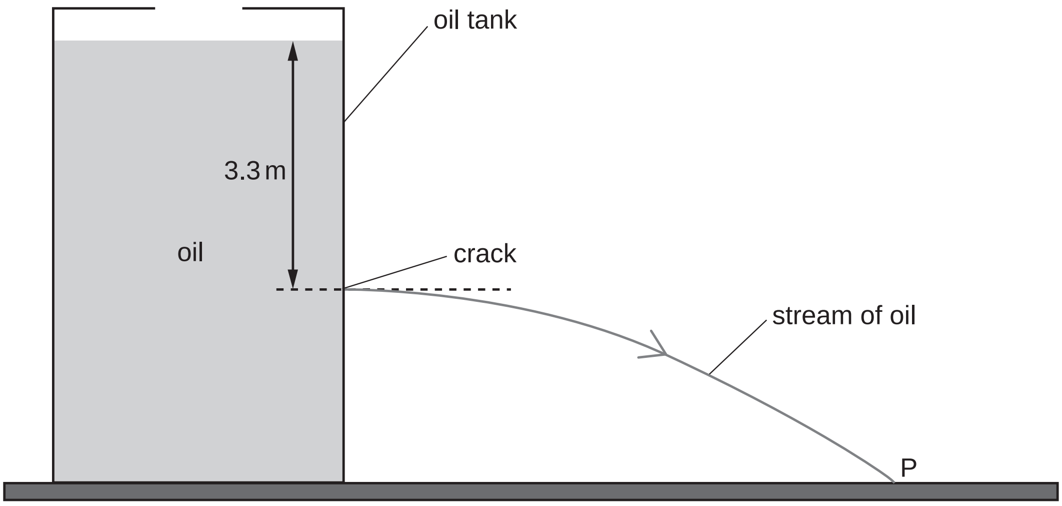


Fig. 2.1

The gravitational field strength *g* is equal to 10 N / kg.

(a) The density of the oil is 940 kg / m^3 and the crack is 3.3 m below the surface of the oil.

(i) Calculate the pressure due to the oil at the level of the crack.

pressure = ... [2]

(ii) Explain why the atmospheric pressure does not affect the rate at which the oil is pushed out through the crack.

....

.... [1]

(b) As time passes, the point where the oil hits the floor moves away from P and towards the tank.

Explain why this happens.

....

....

.... [2]

Question # 29: May June 2019/P22/Q2

Fig. 2.1 shows a container of gas connected to a manometer. The tube in the manometer has a constant cross-sectional area.

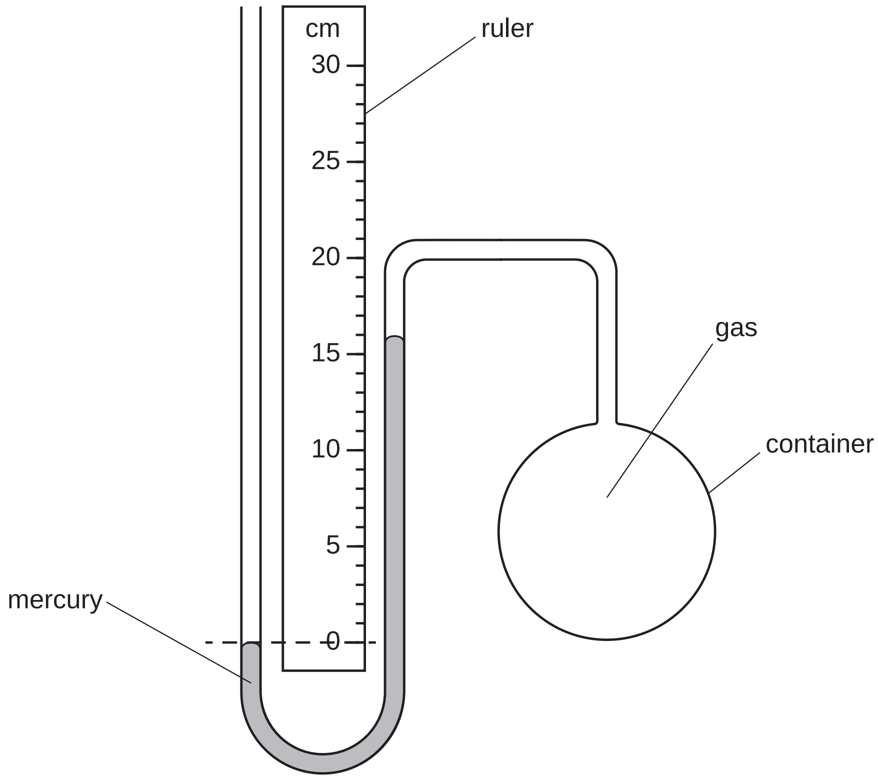


Fig. 2.1

The gas in the container exerts a pressure.

(a) Define the term *pressure*.

....

.... [1]

(b) The density of mercury is 1.4×10^4 kg/m^3. The gravitational field strength *g* is 10 N/kg.

The pressure of the atmosphere is 1.0×10^5 Pa.

Calculate the pressure of the gas in the container.

pressure = ... [3]

(c) In Fig. 2.1, the mercury level on the left-hand side of the manometer is lower than on the right-hand side.

The gas inside the container is heated. This causes the mercury levels on both sides to become the same.

(i) Determine the mercury level, as shown on the ruler, when this happens.

.... [1]

(ii) Explain, in terms of the gas molecules, what causes the level of mercury to become the same.

....

....

....

....

....

.... [3]

[Total: 8]

Question # 30: May June 2020/P22/Q3

Fig. 3.1 shows part of a hydraulic press that is used to compress waste paper into a brick for burning.

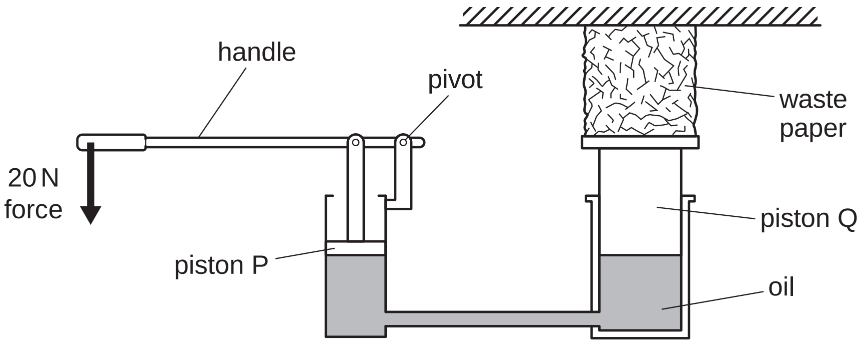


Fig. 3.1

A force of 20 N is exerted downwards on the end of the handle.

(a) The force on the handle creates a moment about the pivot.

(i) Define the *moment of a force*.

....

....

....

.... [2]

(ii) Explain why the force exerted on piston P is greater than the force exerted on the handle.

....

....

.... [1]

(b) Explain how the hydraulic press enables a greater force to be exerted on piston Q than is exerted on piston P.

....

....

....

....

.... [2]

(c) In moving the handle downwards, the 20 N force moves through a distance of 0.60 m and piston Q rises by 0.020 m.

The force exerted by piston Q on the paper is 400 N.

Calculate:

(i) the work done in moving the handle downwards

work = ... [2]

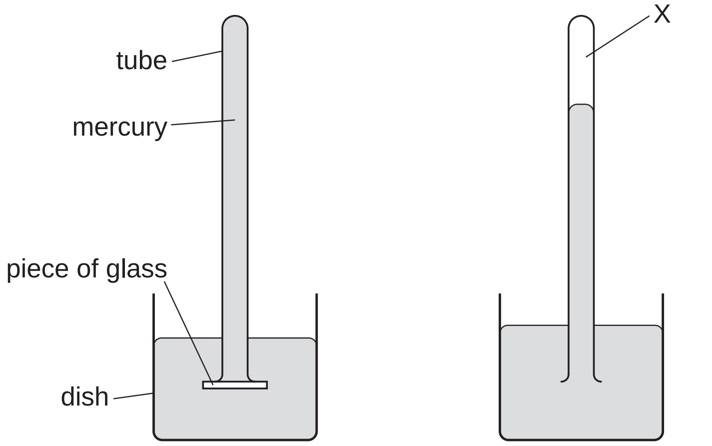
(ii) the efficiency of the hydraulic press.

efficiency = ... [2]

[Total: 9]

Question # 31: Oct Nov 2019/P21/Q1

Fig. 1.1 shows a tube full of mercury placed upside down in a dish of mercury. Initially a small piece of glass closes the open end of the tube.



with piece of glass

Fig. 1.1

without piece of glass

Fig. 1.2

(a) The piece of glass is removed and the level of mercury in the inverted tube falls, as shown in Fig. 1.2.

(i) Explain why the level of mercury in the tube falls.

....

....

....

.... [2]

(ii) State what is found at point X in Fig. 1.2.

.... [1]

(b) Describe how the tube of mercury in Fig. 1.2 is used to determine a value for the atmospheric pressure in pascals (Pa). You may draw on Fig. 1.2 if you wish.

....

....

....

.... [3]

[Total: 6]

Question # 32: Oct Nov 2019/P22/Q2

A student uses a pump to inflate a bicycle tyre.

Fig. 2.1 shows the pump and the tyre.

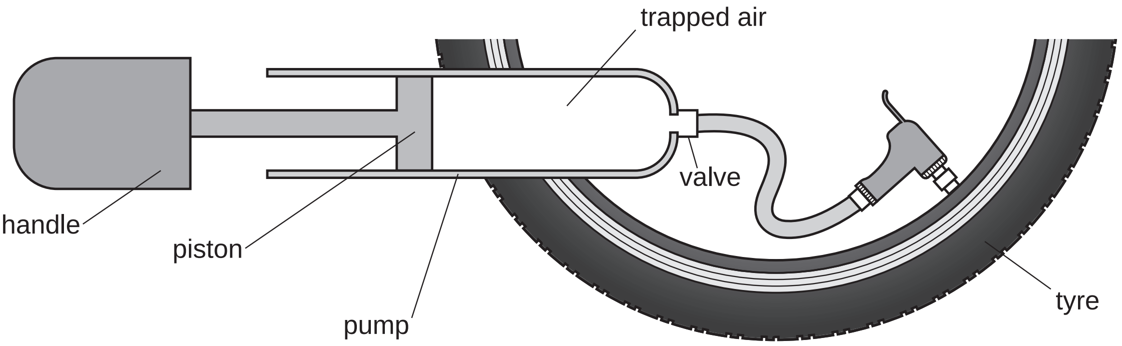


Fig. 2.1 (not to scale)

(a) The pressure of the trapped air in the pump is 3.8×10^5 Pa and the cross-sectional area of the piston is $6.1 \times 10^{-4}\,m^2$.

(i) Calculate the force exerted on the piston by the trapped air in the pump.

force = ... [2]

(ii) The student pushes the handle to the right and the piston forces the trapped air into the tyre. The force exerted by the student is less than the value in **(a)(i)**.

Suggest one reason why.

....

.... [1]

(b) The temperature of the air in the pump remains constant as the handle moves to the right.

Explain, in terms of its molecules, why the pressure of a gas increases when its volume is decreased at constant temperature.

....

....

....

....

.... [3]

[Total: 6]

Question # 33: Oct Nov 2020/P21/Q8

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

At a depth of 25 m beneath the surface of the lake, the total pressure is 3.5×10^5 Pa.

(a) State what is meant by *pressure*.

....

.... [1]

(b) The gravitational field strength is 10 N / kg.

Determine:

(i) the pressure due to 25 m of water

pressure = ... [2]

(ii) the atmospheric pressure.

atmospheric pressure = ... [1]

(c) An underwater depth gauge contains a small cylinder as shown in Fig. 8.1. Gas is trapped inside the cylinder by a piston. The piston is free to move.

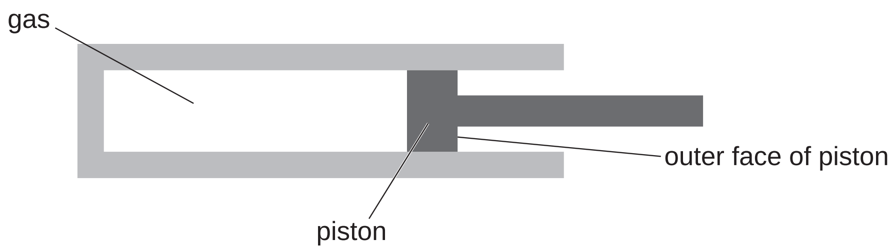


Fig. 8.1

The outer face of the piston is in contact with the water.

As the depth gauge is lowered into the water, the piston moves into the cylinder. This moves a needle on a dial to indicate the depth of the gauge in the water.

(i) Explain why the piston moves into the cylinder.

....

....

....

....

.... [3]

(ii) The temperature of the gas does not change as the piston moves into the cylinder.

Explain, in terms of molecules, what happens to the pressure of the trapped gas as the piston moves into the cylinder.

....

....

....

.... [3]

(iii) At the surface of the water, the volume of the trapped gas in the depth gauge is V_0.

On Fig. 8.2, sketch a graph to show how the volume of trapped gas decreases as the gauge is lowered into the water.

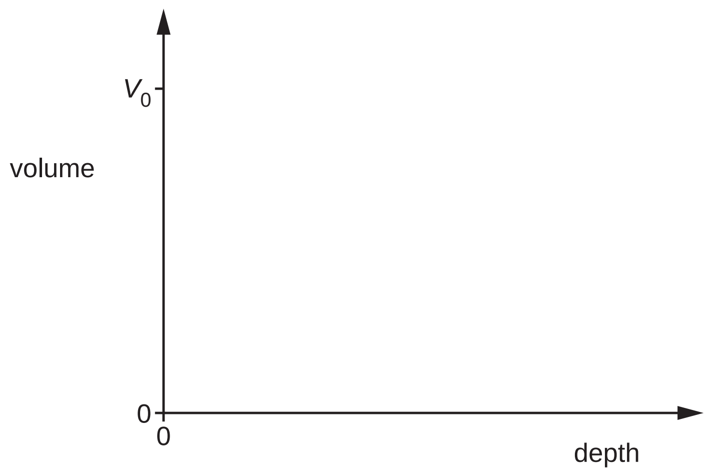


Fig. 8.2

[2]

(iv) The instructions for the depth gauge state that, each time it is used, the needle of the dial must be re-set to zero at the surface of the water.

Suggest **one** reason for this.

....

.... [1]

(v) The density of the air trapped in the depth gauge increases. The density of the water remains constant.

Explain, in terms of the molecules of the water, why the density of the water remains constant.

....

....

.... [2]

[Total: 15]