

1 (a) The following are three statements about boiling.

- A liquid boils at a fixed temperature.
- During boiling, vapour can form at any point within the liquid.
- Without a supply of thermal energy, boiling stops.

Complete the following equivalent statements about evaporation.

- A liquid evaporates at
.....
- During evaporation
.....
- Without a supply of thermal energy, evaporation [3]

(b) A pan containing water boiling at 100 °C is standing on an electrically heated hot-plate. In 20 minutes, 0.075 kg of water is lost as steam. The specific latent heat of vaporisation of water is $2.25 \times 10^6 \text{ J/kg}$.

(i) Calculate the energy used in converting 0.075 kg of boiling water to steam.

energy = [2]

(ii) The hot-plate operates at 240V, 0.65 A.

Calculate the energy supplied to the hot-plate in 20 minutes.

energy = [2]

(iii) Suggest why the answers to (b)(i) and (b)(ii) are not the same.

.....
..... [1]

[Total: 8]

2 (a) Complete the following statements by writing appropriate words in the spaces.

The pressure of a gas in a sealed container is caused by the collisions of
..... with the container wall.

An increase in the temperature of the gas increases the pressure because the
..... of the increases.

The force on the wall due to the gas is the pressure multiplied by the
of the wall. [2]

(b) A mountaineer takes a plastic bottle containing some water to the top of a mountain. He removes the cap from the bottle, drinks all the water and then replaces the cap, as shown in Fig. 6.1.

On returning to the base of the mountain, he finds that the bottle has collapsed to a much smaller volume, as shown in Fig. 6.2.



Fig. 6.1

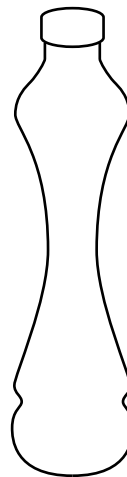


Fig. 6.2

(i) Explain why the bottle collapsed.

.....
.....
.....
..... [2]

- (ii) At the top of the mountain the atmospheric pressure was $4.8 \times 10^4 \text{ Pa}$ and the volume of the bottle was 250 cm^3 .

Calculate the volume of the bottle at the base of the mountain where the pressure of the air inside the bottle is $9.2 \times 10^4 \text{ Pa}$. Assume no change of temperature.

volume = [3]

[Total: 7]

- 3 During a period of hot weather, the atmospheric pressure on the pond in Fig. 3.1 remains constant. Water evaporates from the pond, so that the depth h decreases.

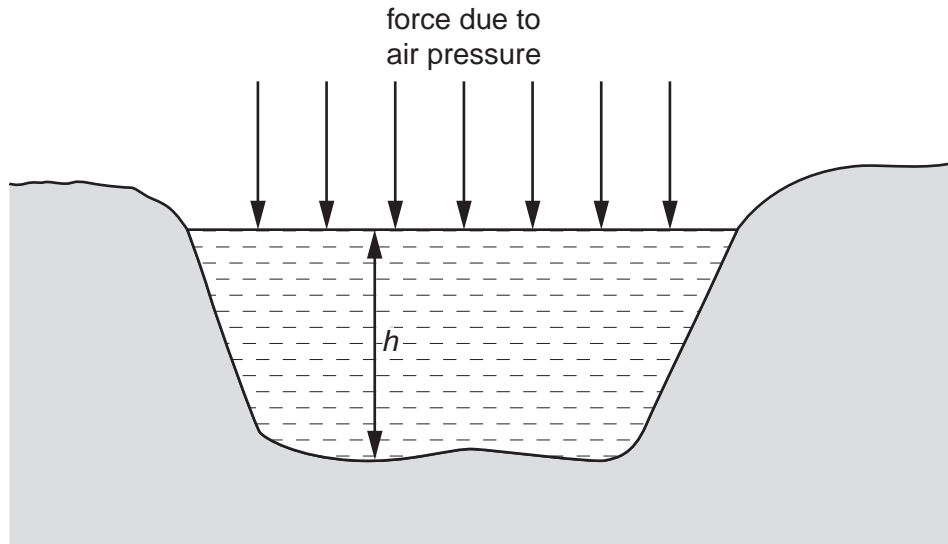


Fig. 3.1

- (a) Study the diagram and state, giving your reason, what happens during this hot period to

- (i) the force of the air on the surface of the pond,

.....
[1]

- (ii) the pressure at the bottom of the pond.

.....
[1]

- (b) On a certain day, the pond is 12 m deep.

- (i) Water has a density of 1000 kg/m^3 .

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

pressure due to the water =[2]

(ii) Atmospheric pressure on that day is 1.0×10^5 Pa.

Calculate the total pressure at the bottom of the pond.

total pressure =[1]

(iii) A bubble of gas is released from the mud at the bottom of the pond. Its initial volume is 0.5 cm^3 .

Ignoring any temperature differences in the water, calculate the volume of the bubble as it reaches the surface.

volume =[2]

(iv) In fact, the temperature of the water is greater at the top than at the bottom of the pond.

Comment on the bubble volume you have calculated in (b)(iii).

.....
.....
.....[1]

[Total: 8]

- 4 A vertical cylinder has a smooth well-fitting piston in it. Weights can be added to or removed from a tray on the top of the piston.
- (a) Weights are added to the tray, as shown in Fig. 6.1.

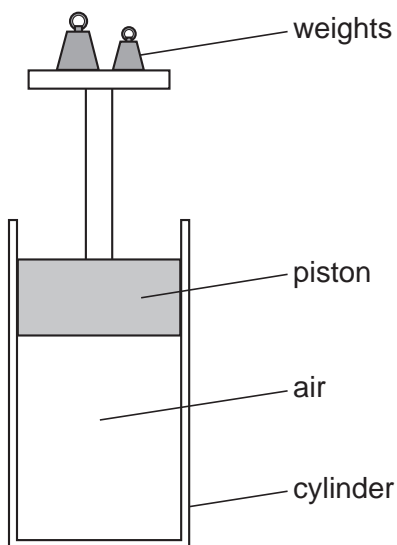


Fig. 6.1

- (i) State what happens to the pressure of the air in the cylinder as a result of adding these weights.

..... [1]

- (ii) The initial pressure of the trapped air is 1.05×10^5 Pa. When the weights are added, the volume of the air decreases from 860 cm^3 to 645 cm^3 .

The temperature of the air does not change.

Calculate the final pressure of the trapped air.

pressure = [3]

(iii) The area of the piston is $5.0 \times 10^{-3} \text{ m}^2$.

Calculate the weight that is added to the piston.

weight added = [4]

(b) The weights are kept as shown in Fig. 6.1. The temperature of the air in the cylinder is increased.

(i) State what happens to the volume of the air in the cylinder as a result of this temperature rise.

..... [1]

(ii) State how, if at all, the pressure of the air changes as the temperature changes.

..... [1]

(iii) State what must be done to prevent the volume change in **(b)(i)**.

..... [1]

(iv) The volume change in **(b)(i)** is prevented. State what happens to the pressure of the air in the cylinder.

..... [1]

[Total: 12]

5 (a) Fig. 5.1 shows a tank used for evaporating salt solution to produce crystals.

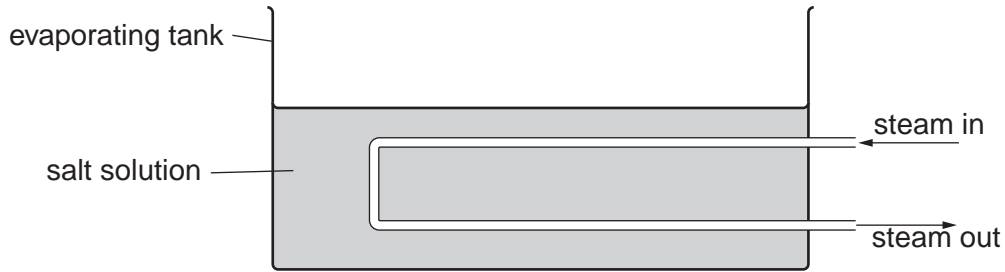


Fig. 5.1

Suggest two ways of increasing the rate of evaporation of the water from the solution. Changes may be made to the apparatus, but the rate of steam supply must stay constant. You may assume the temperature of the salt solution remains constant.

1.
.....
2.
.....[2]

(b) A manufacturer of liquid-in-glass thermometers changes the design in order to meet new requirements.

Describe the changes that could be made to

- (i) give the thermometer a greater range,
.....[1]
- (ii) make the thermometer more sensitive.
.....[1]

(c) A toilet flush is operated by the compression of air. The air inside the flush has a pressure of 1.0×10^5 Pa and a volume of 150cm^3 . When the flush is operated the volume is reduced to 50cm^3 . The temperature of the air remains constant during this process.

Calculate the new pressure of the air inside the flush.

pressure =[2]