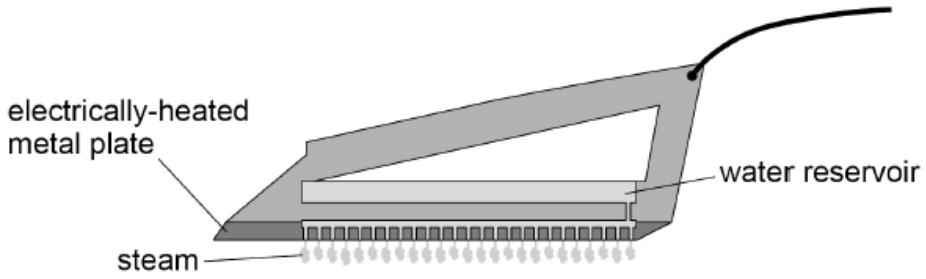
Thermal physics – A2 Physics P2

1. No.1

0 1 **Figure 1** shows an electric steam iron.

Figure 1



Water from a reservoir drips onto an electrically-heated metal plate. The water boils and steam escapes through holes in the metal plate.

The electrical power of the heater inside the iron is 2.1 kW.

Assume that all the energy from the heater is transferred to the metal plate.

0 1 . 1 The metal plate has a mass of 1.2 kg and is initially at a temperature of 20 °C. The heater is switched on. After a time t the metal plate reaches its working temperature of 125 °C.

Calculate t.

specific heat capacity of the metal = 450 J kg^{-1} K^{-1}

[2 marks]

t = _____ s

0 1 . 2 The metal plate is maintained at its working temperature.
Water at $20\ °C$ drips continuously onto the metal plate.
Steam at $100\ °C$ emerges continuously from the iron.

The maker claims that the iron can generate steam at a rate of $60\ g\ min^{-1}$.

Determine whether this claim is true.

specific latent heat of vaporisation of water $= 2.3 \times 10^6\ J\ kg^{-1}$
specific heat capacity of water $= 4200\ J\ kg^{-1}\ K^{-1}$

[3 marks]

2. No.2

0 2 . 1 In the kinetic theory model, it is assumed that there are many identical particles moving at random.

State **two** other assumptions made in deriving the equation $pV = \frac{1}{3}Nm\,(c_{\text{rms}})^2$.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

0 2 . 2 Explain why molecules of a gas exert a force on the walls of a container.
Refer to Newton's laws of motion in your answer.

[3 marks]

_____

_____

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_____

0 2 . 3 A sealed flask of volume $0.35\ \text{m}^3$ contains an ideal gas at a pressure of $220\ \text{kPa}$. The mean kinetic energy of the gas molecules is $6.7 \times 10^{-21}\ \text{J}$.

Calculate the amount of gas in the container.

[3 marks]

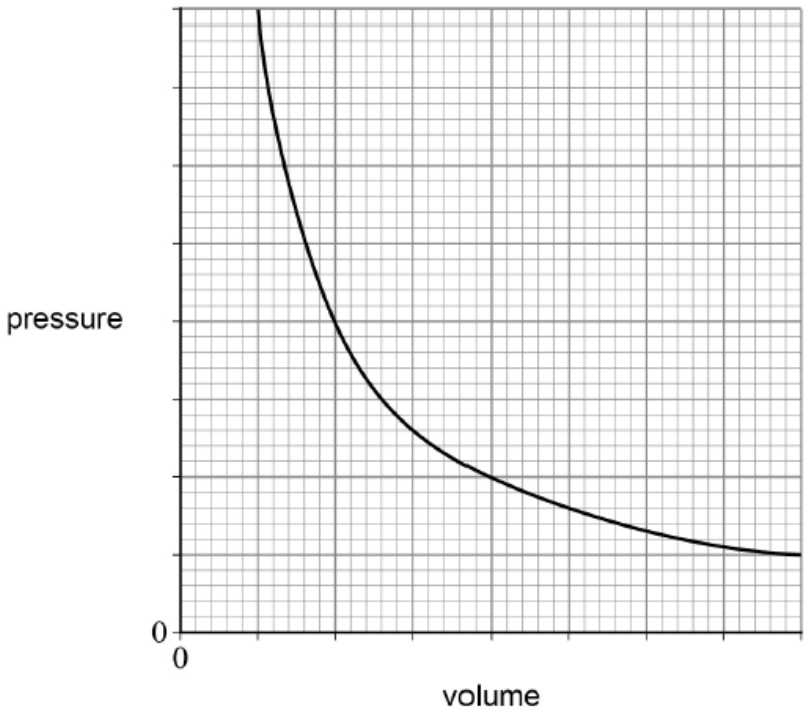
amount of gas = _____ mol

0 2 . 4 **Figure 2** shows the variation of pressure with volume for a fixed mass of an ideal gas at constant absolute temperature T.

Draw, on **Figure 2**, the graph for the same gas at temperature $2T$.

[2 marks]

Figure 2



3. No.7

An ideal gas, initially at 300 K, is compressed to half its original volume. It is then cooled at constant volume until the pressure is restored to its initial value.

What is the final temperature of the gas?

[1 mark]

A 150 K ⬭

B 200 K ⬭

C 300 K ⬭

D 600 K ⬭

4. No.8

A fixed volume of an ideal gas is heated.

Which row gives quantities that double when the kelvin temperature of the gas doubles?

[1 mark]

A	rms speed of the molecules	pressure of the gas	⬭
B	density of the gas	rms speed of the molecules	⬭
C	internal energy of the gas	density of the gas	⬭
D	pressure of the gas	internal energy of the gas	⬭