Pressure

Total marks:20

Q1.

Figure 3 shows an oxygen cylinder.

Figure 3

The volume of the gas in the cylinder is 2100 cm^3.

When the gas is released into the atmosphere the volume of the gas is 8600 cm^3.

The pressure of the atmosphere is 98 kPa.

Calculate the pressure of the gas when it is in the cylinder.

Use the equation

$$P_1 = \frac{P_2 \times V_2}{V_1}$$

(2)

pressure of the gas in the cylinder = ... kPa

(Total for question = 2 marks)

Q2.

Figure 1 shows a fixed mass of gas inside a cylinder with a movable piston.

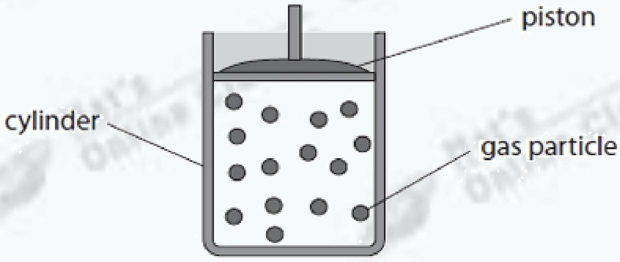

Figure 1

(i) Describe, in terms of **gas particles**, how the gas exerts a pressure on the cylinder.

(3)

....

....

....

....

....

(ii) Figure 2 shows the same gas squashed into a smaller volume.

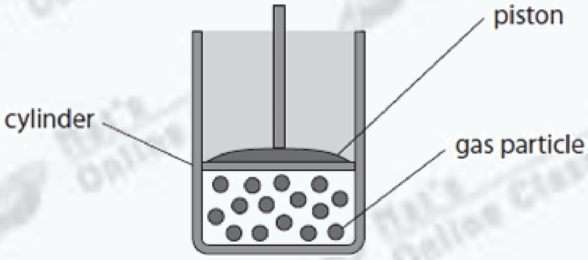

Figure 2

State what happens to the pressure the gas exerts on the cylinder when the volume of gas is reduced, as in Figure 2.

(1)

....

....

(iii) State what happens to the gas particles when the volume of the gas is reduced, as in Figure 2.

(1)

....

....

(Total for question = 5 marks)

Q3.

Figure 8 shows a small container of carbon dioxide at high pressure.

The pressure, P_1 , in the container is 8.00 MPa.

The volume, V_1 , of the container is 14.5 cm^3.

Figure 8

The container is pierced and all of the carbon dioxide goes into a large balloon.

The volume of gas, V_2, in the large balloon is 1160 cm^3.

Calculate the pressure, P_2, in the large balloon.

Use the equation

$$P_1V_1 = P_2V_2$$

(3)

pressure in the large balloon = ... MPa

(Total for question = 3 marks)

Q4.

A student investigates the pressure and volume of some trapped gas.
Figure 4 shows the apparatus used.

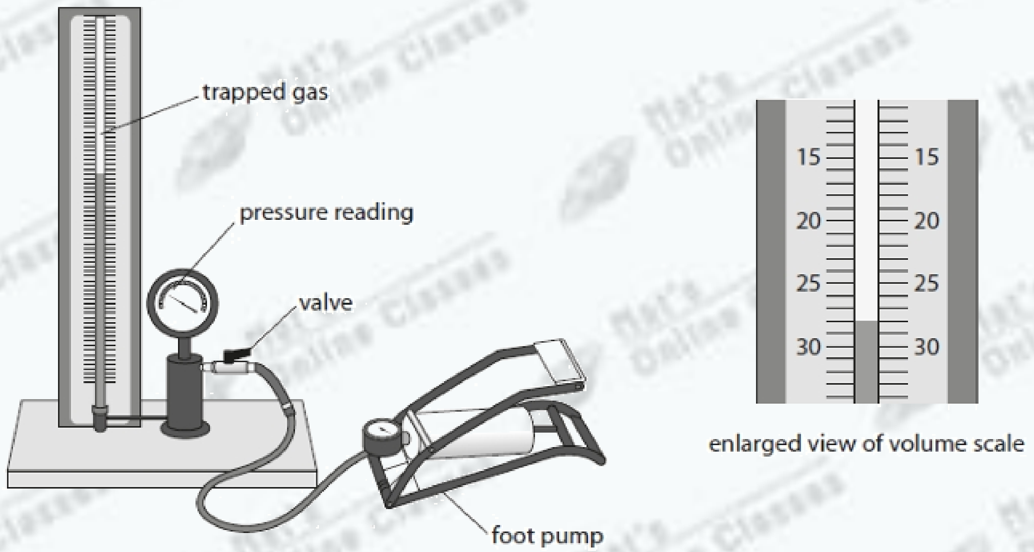

Figure 4

Figure 5 shows the student's table of results.

p	*V*	*p* × *V*
100	28.0	2800
123	23.0	2829
140	20.0	2800
160	18.0	2880
180	16.5	2970

Figure 5

(i) Suggest what the student should add to the headings of the table in Figure 5.

(1)

....

....

(ii) Use Figure 5 to estimate the volume of gas for a pressure reading of '170'.

(2)

volume of gas = ...

(iii) Suggest **two** ways the student could improve the investigation.

(2)

1 ....

....

2 ....

....

(iv) Explain whether the values, in the column headed '$p \times V$' in Figure 5, fit the equation

$$p_1 \times V_1 = p_2 \times V_2$$

(3)

....

....

....

....

....

....

(Total for question = 8 marks)

Q5.

Figure 16 shows a metal container with a movable piston.

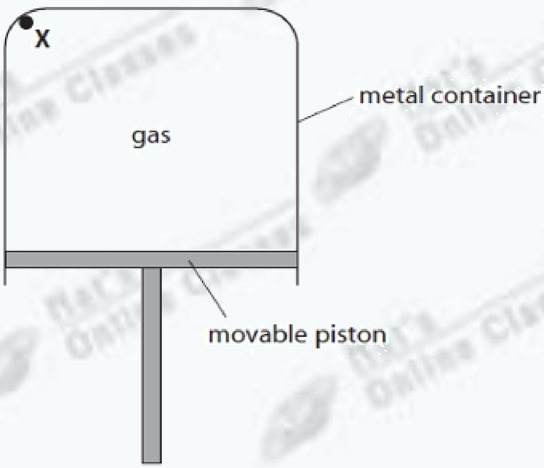

Figure 16

Point X is on the inner surface of the container.

The gas in the container is at a higher pressure than the air outside the container.

The pressure of the gas in Figure 16 (P_1) is 120 kPa.

The volume of the gas in Figure 16 (V_1) is 2500 cm^3.

The piston is pushed up slowly so that the temperature of the gas does not change.

The new volume of the gas (V_2) is 1600 cm^3.

Calculate the new pressure of the gas, P_2.

Use the equation

$$P_2 = \frac{P_1 \times V_1}{V_2}$$

(2)

new pressure, P_2 = ... kPa

(Total for question = 2 marks)

Mark scheme:

Q1.

Question Number:	Answer	Additional guidance	Mark
	substitution (1) $(P_1) = \frac{98 \times 8600}{2100}$ evaluation (1) 400 (kPa)	accept any answer that rounds to 400 eg. 401.33 (kPa) award full marks for the correct answer without working.	**(2)** AO 2 1

Q2.

Question Number:	Answer	Additional guidance	Mark
(i)	a description to include 3 of the following: gas particles/molecules/atoms are continually in motion (1) collide /hit/bombard (1) with the (sides/walls) of the container (1) (gas particles) exert force (on the side of the container) (1)	allow cylinder /glass	**(3)** AO 1 1

Question Number:	Answer	Additional guidance	Mark
(ii)	pressure (of gas) increases (1)		**(1)** AO 1 1

Question Number:	Answer	Additional guidance	Mark
(iii)	more (frequent) collisions (of particles with walls) (1)	accept particles move closer together particles move faster	**(1)** AO 1 1

Q3.

Question Number	Answer	Additional guidance	Mark
	substitute (1) 8.00 x 14.5 = P_2 x 1160 rearrangement (1) $\frac{8.00 \times 14.5}{1160}$ ($=P_2$) evaluation 0.1 (MPa)	Allow 8.00 x 14.5 =116 for one mark award full marks for the correct answer without working	**(3)**

Q4.

Question number	Answer	Additional guidance	Mark
i	(headings to the table should have) **units** or **names** (1)	accept any correct unit suggestion e.g. cm^3 / Pascals or any correct name e.g. pressure / volume	(1) AO3

Question number	Answer	Additional guidance	Mark
ii	attempts to find any 'in between number' (interpolates) (1) evaluation (1) 17.2, 17.3 or 17.25	accept any number between 16.6 and 17.9 award full marks for correct answer without working	(2) AO3

Question number	Answer	Additional guidance	Mark
iii	Suggestions, including any **two** from: take intervening pressure reading(s) (1) give (plenty of) time between readings (1) use apparatus with smaller scale divisions (1) take repeat readings and average (1) make sure temperature stays constant (1)	 e.g. steps of 0.2 cm^3 on volume scale allow repeat to check for anomaly e.g. check temperature of the room ignore any ideas of extending the investigation	**(2) AO3**

Question number	Answer	Additional guidance	Mark
iv	An explanation including any **three** from: any reference to data from the table (1) (the product) p x V remains constant (1) for most readings p x V is similar / close to 2800 (1) which points to $p_1 \times V_1 = p_2 \times V_2$ (1) OR equation doesn't fit because values are different (mp4 dependent upon mp2 / mp3) last value(s) of p x V discordant compared with the others (1)	 e.g. no, because almost all the (pV) values are different agrees / disagrees with hypothesis last value(s) values of pV don't agree	**(3) AO3**

Q5.

Question number	Answer	Additional guidance	Mark
	substitution (1) (P_2=) $\frac{120 \times 2500}{1600}$ evaluation (1) 190 (kPa)	award full marks for the correct answer without working accept values that round to 190; e.g.187.5, 188, 187	**(2)**