GAS LAWS

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

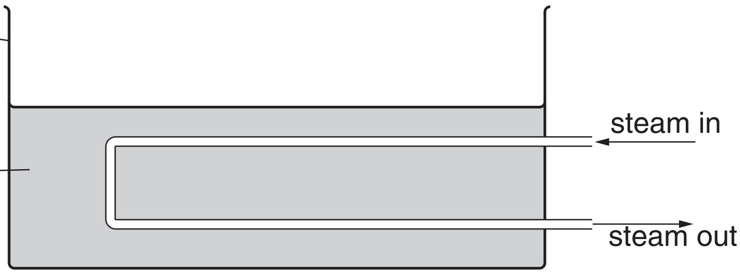

Fig. 5.1

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 150 cm^3. When the flush is operated the volume is reduced to 50 cm^3. The temperature of the air remains constant during this process.
Calculate the new pressure of the air inside the flush.

pressure = ...[2]

(a)	increase surface area of tank		B1	
	blow air over surface/put in windy place		B1	**2**
(b)	**(i)**	capillary tube longer or liquid with lower expansivity	B1	
	(ii)	capillary tube thinner/finer or liquid with higher expansivity or bigger bulb	B1	**2**
(c)	$p_1v_1 = p_2v_2$ or $1 \times 10^5 \times 150 = p_2 \times 50$		C1	
	$p_2 = 3 \times 10^5$ (Pa)		A1	**2**
				[6]

2 Fig. 4.1 shows a sealed glass syringe that contains air and many very tiny suspended dust particles.

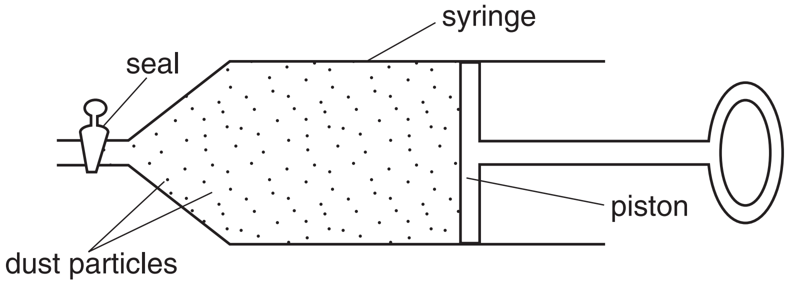

Fig. 4.1

(a) Explain why the dust particles are suspended in the air and do not settle to the bottom.

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....

....[3]

(b) The air in the syringe is at a pressure of 2.0×10^5 Pa. The piston is slowly moved into the syringe, keeping the temperature constant, until the volume of the air is reduced from $80\,cm^3$ to $25\,cm^3$. Calculate the final pressure of the air.

pressure = ...[3]

(a)	air molecules hit dust particles	**M1**	
	hits continuously/unevenly/hits cause movement in all directions	**A1**	
	air molecules fast moving/high energy	**B1**	**3**
(b)	any attempt to use p x v = constant or correct	**C1**	
	proportion	**C1**	
	fraction 2 x 80/25 seen	**A1**	**3**
	p = 6.4 x 10 (Pa)		
			[6]

3 **(a)** Fig. 4.1 shows a cylinder containing air at a pressure of 1.0×10^5 Pa. The length of the air column in the cylinder is 80 mm.

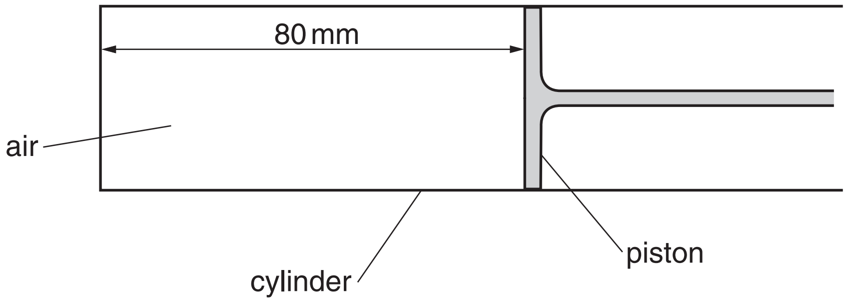

Fig. 4.1

The piston is pushed in until the pressure in the cylinder rises to 3.8×10^5 Pa.

Calculate the new length of the air column in the cylinder, assuming that the temperature of the air has not changed.

new length = ... [3]

(b) Fig. 4.2 shows the same cylinder containing air.

Fig. 4.2

The volume of the air in the cylinder changes as the temperature of the air changes.

(i) The apparatus is to be used as a thermometer. Describe how two fixed points, 0 °C and 100 °C, and a temperature scale could be marked on the apparatus.

....

....

....

....

(ii) Describe how this apparatus could be used to indicate the temperature of a large beaker of water.

....

....

....

....

[5]

a	p.v. is a constant, (so p.l. is a constant), however expressed	C1
	80 x 1 = l x 3.8, however expressed	C1
	l = 21 mm	A1 3
b(i)	put in (melting) ice and put in steam (over boiling water)	M1
	mark piston position for one or both fixed points	A1
	Any reference to wait for equilibrium, however expressed	A1
	Divide length between fixed points into 100 or other suitable calibration	A1 M3
(ii)	immerse cylinder in water (so that water covers at least the air column)	M1
	leave for long time however expressed	A1
	read length, use scale to give temp.	A1 M2
		QT 8