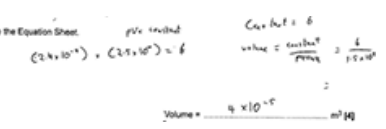
Mark scheme

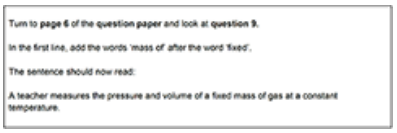
Question			Answer/Indicative content	Marks	Guidance
1	a		In the range 740 to 859 (kg / m^3) ✓	1 (AO 3.1a)	**Examiner's Comments** Most candidates gave an answer of 800 kg / m^3 which is sensibly midway between the two bars for A and D.
	b		treacle ✓	1 (AO 3.1b)	**Examiner's Comments** Most candidates correctly answered treacle. A small number of candidates gave alcohol - possibly thinking about the answer to the previous part. Candidates should be encouraged to underline key words in the question.
	c		**First check the answer on the answer line** **If answer = 15000 (Pa) award 2 marks** (P=hρg) P = 1.5 x 1000 x 10 ✓ P = 15000 (Pa) ✓	2 (AO 2.1) (AO 2.1)	15 x 10^3 or 1.5 x 10^4 (Pa) OR 15 kPa (unit needed) **Examiner's Comments** The majority of the candidates correctly substituted the data in the equation and gained full marks.
	d		Any **one** from: Objects float when upthrust is equal to weight ✓ Objects float when weight of liquid displaced equals the weight of the object ✓ Objects float when the density of the object is less than the density of the liquid ✓ Any **one** from: Objects sink when weight is greater than upthrust ✓ Objects sink when weight of liquid displaced is less than the weight of the object ✓	2 (AO 1.1 x2)	**Examiner's Comments** Most candidates who answered in terms of density scored both marks. Some candidates used the quantities 'weight' and 'upthrust' for the explanation. Most correctly stated that an object sinks when the weight is larger than the upthrust, but then stated incorrectly that an object floats when the upthrust is larger than the weight. **Misconception** An object floats when the upthrust is equal to the weight of the object. If the upthrust was greater than the

			Objects sink when the density of the object is more than the density of the liquid ✓		weight, there would be a resultant force upwards.
			Total	**6**	
2	a		Apply a force to the piston ✓	1 (AO 1.2)	**IGNORE** increase the pressure / decrease the volume / syringe **ALLOW** heat the gas **ALLOW** push / move the (moveable) piston (in) **DO NOT ALLOW** pull / move out piston (CON) **Examiner's Comments** This question was well answered.
	b	i	The pressure halves / reduces / goes down / decreases ✓ **AND** The rate of collisions with the sides (of the container) decreases ✓✓ **OR** There are fewer collisions with the sides (of the container) ✓ Less frequent collisions / more time between collisions ✓	3 (AO 3.2b) (AO 1.1x2)	**IGNORE** reverse argument **ALLOW** walls / surface (of the container) **ALLOW** rate of change of momentum of particles with the sides (of the container) decreases ✓✓ **ALLOW** less frequent collisions with the sides (of the container) ✓✓ **IGNORE** less likely **ALLOW** less often collisions **Examiner's Comments** Most candidates were able to state that the pressure decreases. It was hoped that more candidates would have stated that the pressure halves. The explanation of why the pressure changes in the container was not always detailed. Many candidates did not state that it was the collisions with the walls of the container (as opposed to each other) and the rate (or frequency) of the collisions that decreased. **Assessment for learning**

					Candidates need to know how to explain the effect of inverse proportionality when one quantity doubles or increases by a factor, in that the other quantity halves or decreases by the same factor.
		ii	**First check the answer on the answer line** **If answer = 4(.0)x10^{-5} (m^3) award 4 marks** (PV = constant) (Constant =) 2.5 x 10^4 x 2.4 x 10^{-4} ✓ (Constant =) 6 ✓ V = constant / P = 6 / 1.5x10^5 ✓ V = 4(.0)x10^{-5} (m^3) ✓	4 (AO 2.1) (AO 2.1) (AO 2.1) (AO 2.1)	**ALLOW** three marks for 4 x 10^n or 1/25000 **ALLOW** three marks for $V_2 = \frac{2.5\times10^4 \times 2.4\times10^{-4}}{1.5\times10^5}$ **ALLOW** use of $P_1V_1 = P_2V_2$ method to calculate a constant ✓ constant value e.g., 6 or 1/6 or 0.17 ✓ use of constant to determine ✓ 4(.0)x10^{-5} (m^3) ✓ e.g., $\frac{2.5\times10^4}{1.5\times10^5} \left(= \frac{P_1}{P_2} = \frac{V_2}{V_1} = \text{constant}\right)$ ✓ (Constant =) 0.167 ✓ V = 2.4x10^{-4} × 0.167 ✓ V = 4(.0)x10^{-5} (m^3) ✓ **<u>Examiner's Comments</u>** This question was answered well. There were a few power of ten errors. High-scoring candidates clearly showed their method, substituting in the correct data. Other combinations of using *p V* = constant also gained credit. Some candidates correctly used $p_1 V_1 = p_2 V_2$. Some candidates correctly worked out the constant but then inverted the final equation - it is this latter case where the earlier working still enables two marks to be scored. Exemplar 2 

Use the Equation Sheet pV = constant (2.4 x 10^{-4}) x (2.5 x 10^4) = 6 Constant = 6 volume = $\frac{\text{constant}}{\text{pressure}} = \frac{6}{1.5\times10^5}$ = 4 x 10^{-5} Volume = 4 x 10^{-5} m^3 [4]

					In Exemplar 2, the candidate has stated the equation $p\ V$ = constant. They have clearly worked out the constant by substituting the correct data into their equation. Then they have rearranged the equation before substituting in the data again to calculate the final volume.
	c		Any **three** from: Work is being done on the gas ✓ Average/mean speed of the particles increases✓ Kinetic energy of the particles increases ✓ Energy from the kinetic store of the gas is transferred to the thermal store (of the gas) ✓ Energy from the thermal store of the gas is transferred to the thermal store of the pump ✓ Temperature is a measure of the average/mean kinetic energy ✓ Friction between piston and the side of the pump ✓	3 (AO 1.1x3)	**IGNORE** Heat transfer from tyre **ALLOW** faster **ALLOW** kinetic energy for kinetic store and thermal energy / heat for thermal store **Examiner's Comments** Candidates found this question challenging. The responses were often vague and lacked the necessary detail. For example, many candidates mentioned work being done without stating the effect of doing work, or that the energy of the gas increases without stating that the mean speed of the gas particles increases (so the kinetic energy of the particles increased).
			Total	**11**	
3			A	1 (AO 1.1)	**Examiner's Comments** Many candidates found this question challenging. A number of candidates incorrectly gave option B (with the density of the atmosphere increasing as the distance from the Earth increases). Another commonincorrect answer was C, for the atmosphere covering the Earth to a height of 700 m.
			Total	**1**	
4			B ✓	1 (AO1.1)	**Examiner's Comments** High scoring candidates worked through each of the distractors eliminating the incorrect answers.

			Total	**1**	
5			D ✓	1 (AO2.1)	**Examiner's Comments** The common incorrect answer was B where candidates did not allow correctly for the km. Candidates should underline data including the units to avoid such errors.
			Total	**1**	
6			C ✓	1 (AO1.1)	**Examiner's Comments** Erratum notice  Turn to page 6 of the question paper and look at question 9. In the first line, add the words 'mass of' after the word 'fixed'. The sentence should now read: A teacher measures the pressure and volume of a fixed mass of gas at a constant temperature. In the final print of the question paper "mass of" was omitted –an erratum notice was issued, and it was clear that candidates had written in the two words. This question was not well answered with many candidates not understanding that the pressure in a fixed mass of gas is inversely proportional to the volume and therefore C was the correct answer. Many candidates selected B and D so realised that the pressure decreased with an increase in volume. A number of candidates also selected A. **Assessment for learning** Understand the types of graphs produced for directly proportional, inversely proportional and linear relationships. Candidates should understand the significance of straight line graphs and how the relationships may be tested.
			Total	**1**	