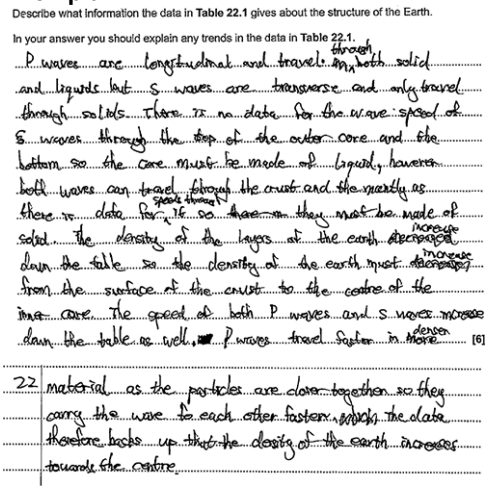
Mark scheme – Pressure (H)

Question			Answer/Indicative content	Marks	Guidance
1			D ✓	1 (AO1.2)	**Examiner's Comments** About two thirds of candidates gave the correct answer D. A common incorrect response was 'C'.
			Total	**1**	
2			D ✓	1 (AO1.1)	**Examiner's Comments** This was well known by nearly all candidates who gave D as their answer.
			Total	**1**	
3			A	1 (AO1.1)	
			Total	**1**	
4			B	1 (AO2.1)	
			Total	**1**	
5			B	1	
			Total	**1**	
6	a		Water is much denser than air / AW (1)	1	
	b		Pressure increases as depth increases (1) Each 10 metres of depth increases pressure by 1 AW (1)	2	**ALLOW** direct / linear relationship
	c		It is the pressure of the atmosphere / AW (1)	1	
	d		Recall of 'g' (1) Substitution into equation (1) 364 / 360 (1) 2 significant figures quoted / 360 (1)	4	9.8 or 10 m/s^2 **ALLOW** 356.72 (3)
			Total	**8**	
7			Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Detailed description of the structure of the	6 (AO 2×3.1a) (AO 2×3.2a)	**AO3.1a Analyse information and ideas to interpret some basic trends in data** • density increases as depth increases

			Earth **AND** Detailed explanation of the trends in **Table 22.1.** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Description of the structure of the Earth. **AND** Explanation of the trends in **Table 22.1.** **OR** Detailed description of the structure of the Earth. **OR** Detailed explanation of the trends in **Table 22.1.** *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** **A basic description of the structure of the Earth.** **OR** A basic description of the trends in **Table 22.1.** *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	(AO 2×2.1)	• speed (of P/S waves) increases as density increases • speed (of P/S waves) increases as depth increases **AO2.1 Apply knowledge and understanding of scientific ideas to explain trends in the data** • Earth contains layers • velocity changes at a boundary • as density changes at a boundary • particles more tightly packed • P is longitudinal, S is transverse **AO3.2a Analyse information and ideas to make judgements about the structure of the Earth** • core has highest density • core has highest speed for P waves • S waves do not travel through the core • so the outer core is a liquid • pressure highest in core / P = ρgh • pressure and so density increase with depth • large change in density between mantle and outer core **<u>Examiner's Comments</u>** This was the Level of Response question, targeted up to Grade 9, and assessed AO2 and AO3. There was a wide range of marks achieved and the question discriminated well. Very few candidates did not achieve any credit. The majority of candidates were able to describe some basic trends in the table for density and speed of P and S waves. More detailed responses also included a description of the structure of the Earth for Level 2. Many excellent responses from the more able candidates at Level 3 included: ● trends in the data identified and explained ● linking facts about P and S waves to an

					explanation of why the outer core is liquid. Poor quality of communication, including contradictions or the same facts repeated a number of times, prevented some candidates from achieving a higher mark. **Exemplar 2** Describe what information the data in **Table 22.1** gives about the structure of the Earth. In your answer you should explain any trends in the data in Table 22.1.  P waves are longitudinal and travel through both solid and liquids but S waves are transverse and only travel through solids there is no data for the wave speed of S waves through the top of the outer core and the bottom so the core must be made of liquid, however both waves can travel through the crust and the mantle as there is data for it so there must be made of solid. the density of the layers of the earth decreased down the table so the density of the earth must decrease from the surface of the crust to the centre of the inner core. The speed of both P waves and S waves increase down the table as well. P waves travel faster in denser material as the particles are closer together so they carry the wave to each other faster, which the data therefore backs up that the density of the earth increases towards the centre. [6] This response achieved Level 3, 6 marks. The candidates included a detailed description of the structure of the Earth, including ideas about density and the liquid outer core. There is also a detailed explanation of the trends shown in the table.
			Total	**6**	
8	a		Pressure is inversely proportional to volume OR ρV = constant for a particular gas OR for any of the gases calculation of p x V ✓ For gas B: 10 x 0.4 = 4 and for gas C: 20 x 0.2 =4 OR Pressure of C is double the pressure of B and volume of C is half the volume of B ✓ B and C ✓	3 (AO3.2b) (AO3.1a) (AO3.2b)	**NOTE** could be written next to table **Examiner's Comments** This question required candidates to use the data in the table which was generally well answered by all candidates. Higher ability candidates clearly stated that pressure is inversely proportional to volume and then went on to state that pressure × volume = constant. Most candidates then calculated for each gas pressure × volume before stating that B and C were the same. A few candidates demonstrated that doubling the pressure halved the volume and

					gained full credit with the appropriate conclusion.
	b		For an increase in temperature / heating of gas: gas particles / molecules / atoms have a higher (average) speed / more (kinetic) energy ORA✓ They collide more frequently / often with the walls (of container) / container AW✓ Bigger force (over same area) equals greater pressure ✓	3 (AO3 x1.1)	**Direction of temperature change must be clear** **ALLOW** move faster for higher (average) speed **ALLOW** linked to increase/decrease of KE if temperature change not explicit **ALLOW** bigger change in momentum **Examiner's Comments** There were a range of marks in this question. Candidates needed to be able to explain either how an increase in temperature affects the gas pressure or a decrease in temperature affects the gas pressure. The direction of the temperature change needed to be clear. Most candidates realised that an increase in temperature resulted in the gas molecules having more kinetic energy and thus a higher average speed. Candidates were then expected to state that the molecules collided more frequently with the walls of the container. Often, "frequently" was omitted from candidates' answers. The final mark was for stating that the more frequent collisions resulted in a large force over the same area which causes a greater pressure. Some candidates correctly explained the larger force in a greater rate of change of momentum. **AfL** Candidates should be encouraged to practise explaining physics concepts in terms of the effect of increasing a quantity on another quantity.
	c		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 5500 (Pa) award 3 marks** pressure due to a column of liquid (Pa) = height of column (m) x density of liquid	3	**ALLOW** three marks for 5390 Pa if g=9.8 N/kg or 5395.5 Pa if g=9.81 N/kg is used

			(kg/m3) x g (N/kg) / P = hρg (no mark – on formula sheet) g = 10 (N/kg) ✓ P = 0.5 x 1100 x 10 ✓ P = 5500 (Pa) ✓	 (AO1.1) (AO2.1) (AO2.1)	 **ALLOW** 9.8(1) N/kg **Examiner's Comments** Most of the candidates correctly selected an equation from the data sheet and used an appropriate value for *g*. Candidates who did not gain credit for this question, tended to just multiply 0.5 by 1100. By understanding that the unit of pressure is Pa or N / m^2, candidates should be able to reason that m × kg / m^3 is not valid.
			Total	**9**	
9			**Any three from:** Boat has bigger upthrust/buoyancy force (compared to weight of lump) / ORA / AW ✓ Upthrust on boat is equal to weight of boat / resultant force is zero / AW ✓ Weight of water displaced by the boat is equal to the weight of the boat / AW✓ (Overall) density of the boat includes the air / ORA /AW✓ (Overall) density of the boat (and air) is less than the density of the water / ORA / AW ✓	3 (AO3x2.1)	**ALLOW** upthrust on lump is less than weight of lump / there is a resultant force (acting downwards) **ALLOW** weight of water displaced by lump is less than weight of lump / AW **ALLOW** hollow for air **ALLOW** maximum of 1 mark for boat is hollow / contains air / ORA / AW
			Total	**3**	