PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



MARK SCHEME

TOPIC 14: PARTICLE MODEL (PACK 2)

SCORE	PERCENTAGE
/60	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Additional guidance	Mark
	A description including: find mass of marble(s) (1) put marble(s) into water (in cylinder) and measure **change** in water level (1) divide mass by volume (1) suitable idea to improve accuracy such as use several marbles (1)	 weigh marble(s) accept volume for water level note level before and after marble(s) added find **volume** of water displaced density = mass/volume in words or symbols subtract mass of bag from total mass of marbles and bag ensure water measured at eye level use appropriately sized measuring cylinder ignore reference to repeating and taking average	**(4)**

Q2.

Question Number	Answer	Additional guidance	Mark
	A description including: find mass of marble(s) (1) put marble(s) into water (in cylinder) and measure **change** in water level (1) divide mass by volume (1) suitable idea to improve accuracy such as use several marbles (1)	 weigh marble(s) accept volume for water level note level before and after marble(s) added find **volume** of water displaced density = mass/volume in words or symbols subtract mass of bag from total mass of marbles and bag ensure water measured at eye level use appropriately sized measuring cylinder ignore reference to repeating and taking average	**(4)**

Q3.

Question number	Answer	Additional guidance	Mark
	A description including idea of change of state / solid **changes** (1) to gas / vapour (directly) (1)	 accept equivalents e.g. turns into / goes from to allow reverse i.e. gas → solid may be via appropriate example e.g. ice → water vapour / steam or reverse (2 marks)	**(2)** **AO1.1**

Q4.

Question number	Answer	Additional guidance	Mark
	descriptions to include any **two** of particles / atoms in solid close(r) together (1) particles / atoms in solid (vibrate) in fixed positions but particles in liquid move (freely) (1) particles in a solid in regular arrangement but particles in liquid are randomly arranged (1) particles in a liquid have more (kinetic) energy (than in a solid) (1)	reverse argument difference asked for so **must compare** for subsequent marking points allow answers in terms of forces between particles	**(2)** **AO1**

Q5.

Question number	Answer	Additional guidance	Mark
	A description including idea of change of state / solid **changes** (1) to gas / vapour (directly) (1)	 accept equivalents e.g. turns into / goes from to allow reverse i.e. gas → solid may be via appropriate example e.g. ice → water vapour / steam or reverse (2 marks)	**(2)** **AO1.1**

Q6.

Question number	Answer	Mark
	An explanation that combines identification –knowledge and reasoning / justification • (particles / atoms / molecules) {hit / collide with} piston (1) • causing a force (on the piston) (1)	**(2)**

Q7.

Question number	Answer	Additional guidance	Mark
	an explanation linking any **three** from: stir the water before taking a reading of temperature (1) (continue to) observe temperature**s** after switching off (1) record the maximum / highest / peak temperature reached (1) take temperature reading at eye level (1) conduction (and convection) take time (1)	allow "for **longer** than 10 minutes" allow wait(ing period) in correct context until the temperature stops changing takes time (for water / thermometer) to heat through	**(3)** **AO1.2**

Q8.

Question number	Answer	Additional guidance	Mark
	an explanation linking any **three** from: stir the water before taking a reading of temperature (1) (continue to) observe temperature**s** after switching off (1) record the maximum / highest / peak temperature reached (1) take temperature reading at eye level (1) conduction (and convection) take time (1)	 allow "for **longer** than 10 minutes" allow wait(ing period) in correct context until the temperature stops changing takes time (for water / thermometer) to heat through	**(3)** **AO1.2**

Q9.

SSQ NO:	CS NO:	Answer	Mark
*		Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 strand 1 (6 marks)** • particles move faster (at a higher temperature) • greater velocity / speed means greater kinetic energy • since KE = ½ m v^2 • heating increases KE (store) • KE (store) increase leads to higher (average) speeds • faster particles (at higher temperature so) hit container with more force / momentum exchange • bigger pressure because p = F / A • particles hit container more frequently (at higher temperature) • so **more** force exerted on (walls of) container	**(6)** **AO1.1**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Summary for guidance

Level	Mark	Additional Guidance	General additional guidance – the decision within levels Eg - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance isolated idea(s) of physics e.g. recognising the speed-temperature relationship or the pressure temperature relationship	Possible candidate responses particles faster (at higher temperature) KE increases pressure increases (at a higher temperature)
Level 2	3–4	Additional guidance limited details about KE **or** limited details about pressure **or** linked ideas about kinetic energy and pressure	Possible candidate responses faster particles have greater kinetic energy (store) (particles) hitting container more often causes greater pressure faster particles cause greater force bigger pressure because force increased
Level 3	5–6	Additional guidance understanding is detailed and fully developed. includes detail about **both** kinetic energy **and** force involvement in pressure, but one aspect may be covered in greater detail than the other one	Possible candidate responses greater speed means greater kinetic energy since KE = ½ m v^2 **AND** bigger pressure because more frequent collisions causes an increase in force greater speed means greater kinetic energy **AND** bigger pressure because p = F / A and (total) force increased because of hitting container walls with bigger momentum (changes)

Q10.

Question number	Answer	Additional guidance	Mark
	an explanation linking specific heat capacity concerns change in temperature (1) whereas specific latent heat concerns change of state (1)	 accept specific heat capacity concerns heating <u>up</u> / cooling accept any named change of state e.g. melting / freezing / evaporating /boiling accept specific latent heat related to no change in temperature	**(2)** **AO1.1**

Q11.

Question number	Answer	Additional guidance	Mark
	an explanation linking specific heat capacity concerns change in temperature (1) whereas specific latent heat concerns change of state (1)	 accept specific heat capacity concerns heating <u>up</u> / cooling accept any named change of state e.g. melting / freezing / evaporating /boiling accept specific latent heat related to no change in temperature	**(2)** **AO1.1**

Q12.

SSQ NO:	CS NO:	Answer	Mark
*		Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 strand 1 (6 marks)** • particles move faster (at a higher temperature) • greater velocity / speed means greater kinetic energy • since KE = ½ m v^2 • heating increases KE (store) • KE (store) increase leads to higher (average) speeds • faster particles (at higher temperature so) hit container with more force / momentum exchange • bigger pressure because p = F / A • particles hit container more frequently (at higher temperature) • so **more** force exerted on (walls of) container	**(6)** **AO1.1**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Summary for guidance

Level	**Mark**	**Additional Guidance**	**General additional guidance – the decision within levels** Eg - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance isolated idea(s) of physics e.g. recognising the speed-temperature relationship or the pressure temperature relationship	Possible candidate responses particles faster (at higher temperature) KE increases pressure increases (at a higher temperature)

Level 2	3–4	Additional guidance limited details about KE **or** limited details about pressure **or** linked ideas about kinetic energy and pressure	Possible candidate responses faster particles have greater kinetic energy (store) (particles) hitting container more often causes greater pressure faster particles cause greater force bigger pressure because force increased
Level 3	5–6	Additional guidance understanding is detailed and fully developed. includes detail about **both** kinetic energy **and** force involvement in pressure, but one aspect may be covered in greater detail than the other one	Possible candidate responses greater speed means greater kinetic energy since KE = ½ m v^2 **AND** bigger pressure because more frequent collisions causes an increase in force greater speed means greater kinetic energy **AND** bigger pressure because p = F / A and (total) force increased because of hitting container walls with bigger momentum (changes)

Q13.

Question number	Answer	Additional guidance	Mark
	an explanation linking density of wood less (than that of water) (1) less (volume of) water displaced (than volume of wood) (1)	allow wood floats / should be submerged allow wood absorbing water allow (idea of) incorrect volume reading allow (idea that) the volume cannot be measured this way	**(2)** **AO2.2**

Q14.

Question number	Answer	Additional guidance	Mark
	an explanation linking density of wood less (than that of water) (1) less (volume of) water displaced (than volume of wood) (1)	 allow wood floats / should be submerged allow wood absorbing water allow (idea of) incorrect volume reading allow (idea that) the volume cannot be measured this way	**(2)** **AO2.2**

Q15.

Question number	Answer	Mark
	An explanation that combines identification – knowledge and reasoning / justification • volume decrease makes the density of particles increase / more crowded idea (1) • increasing the **rate** at which particles collide (with the piston) (1)	**(2)**

Q16.

Question Number	Answer	Acceptable answers	Mark
(a) (i)	10.8 + or – 0.2 (cm)	Any value between 10.6(cm) and 11.0 (cm) Accept 11 cm	**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	B $2.1 \times 10^{-2}\,cm^3$		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(iii)	Temperature conversion to K 50°C to 323K **OR** 100°C to 373K (1) Substitution $V_1 = \frac{2.31 \times 10^{-2} \times 373}{323}$ (1) Evaluation 2.67×10^{-2} (cm^3) (1)	 If equation is transformed to give V_2, allow correct substitution mark. $0.0267(cm^3)$, 2.7×10^{-2} (cm^3), $0.027(cm^3)$, 2.67×10^{-8} m^3, 2.7×10^{-8} m^3 Allow power of ten error for 2 marks e.g. 267 Allow 2.6×10^{-2} for 3 marks Full marks for correct answer with no working If temperature is not converted to Kelvin, maximum two marks e.g. $V_1 = \frac{2.31 \times 10^{-2} \times 100}{50}$ $4.62 \times 10^{-2}(cm^3)$ Allow power of ten error for 1 mark e.g. 4.62 2 marks for 4.62×10^{-2} (cm^3) with no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
(b)	A description including: (Average) KE/it increases as the temperature increases (1) Idea of proportionality / KE doubles when the temperature doubles (1) (when) temperature in Kelvin /K (1)	Allow energy for kinetic energy Or reverse argument - (Average) KE/it is (directly) proportional to the Kelvin temperature gets all three marks (Average) KE/it is (directly) proportional to the temperature gets first two marks Allow absolute scale	**(3)**

Q17.

Question Number	Answer	Acceptable answers	Mark
(a) (i)	10.8 + or – 0.2 (cm)	Any value between 10.6(cm) and 11.0 (cm) Accept 11 cm	**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	B $2.1 \times 10^{-2}\,cm^3$		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(iii)	Temperature conversion to K 50°C to 323K **OR** 100°C to 373K (1) Substitution $V_1 = \frac{2.31 \times 10^{-2} \times 373}{323}$ (1) Evaluation $2.67 \times 10^{-2}\,(cm^3)$ (1)	 If equation is transformed to give V_2, allow correct substitution mark. $0.0267(cm^3)$, $2.7 \times 10^{-2}\,(cm^3)$, $0.027(cm^3)$, $2.67 \times 10^{-8}\,m^3$, $2.7 \times 10^{-8}\,m^3$ Allow power of ten error for 2 marks e.g. 267 Allow 2.6×10^{-2} for 3 marks Full marks for correct answer with no working If temperature is not converted to Kelvin, maximum two marks e.g. $V_1 = \frac{2.31 \times 10^{-2} \times 100}{50}$ $4.62 \times 10^{-2}(cm^3)$ Allow power of ten error for 1 mark e.g. 4.62 2 marks for $4.62 \times 10^{-2}\,(cm^3)$ with no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
(b)	A description including: (Average) KE/it increases as the temperature increases (1) Idea of proportionality / KE doubles when the temperature doubles (1) (when) temperature in Kelvin /K (1)	Allow energy for kinetic energy Or reverse argument - (Average) KE/it is (directly) proportional to the Kelvin temperature gets all three marks (Average) KE/it is (directly) proportional to the temperature gets first two marks Allow absolute scale	**(3)**

Q18.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	C stationary		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	(Average KE/it is) halved	divided by 2,multiplied by 0.5	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	Explanation in terms of particles linking the following:- • particles collide with / hit /strike / bombard (1) • the wall / sides of the balloon (1) • (causing a) force / (rate of) change in momentum (1)	 Accept "molecules/atoms" for particles Must mention particles etc to gain this mark Ignore "push"	**(3)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	-46 + 273 (1)	273-46 / any use of 273	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	substitution: (1) $\frac{101 \times 9.1}{273} = \frac{1.12 \times V_2}{227}$ Transposition (1) $V_2 = \frac{101 \times 9.1 \times 227}{273 \times 1.12}$ evaluation: (1) 682 (m^3)	Accept either Pa or kPa for substitution substitution and transposition in any order ignore power of ten error until evaluation 680 (m^3), 682.4 (m^3), 682.35 (m^3) full marks for the correct numerical answer without working	**(3)**

Question Number	Answer	Acceptable answers	Mark
(c)(iii)	bursts/explodes or words to that effect		**(1)**

(Total marks for question = 10 marks)

Q19.

Question number	Answer	Additional guidance	Mark
	An answer that combines **any four** of the following points of understanding to provide a logical description: • chooses either thermocouple or infra-red thermometer (1) • molten steel is poured into a crucible (1) • a stopwatch is started (1) • the crucible + contents are allowed to cool down (in the room) (1) • temperatures are taken at regular intervals (e.g. every minute) (1)	any interval with steel – every 10 minutes etc.	**(4)**

Q20.

Question number	Answer	Additional guidance	Mark
	An answer that combines **any four** of the following points of understanding to provide a logical description: • chooses either thermocouple or infra-red thermometer (1) • molten steel is poured into a crucible (1) • a stopwatch is started (1) • the crucible + contents are allowed to cool down (in the room) (1) • temperatures are taken at regular intervals (e.g. every minute) (1)	any interval with steel – every 10 minutes etc.	**(4)**

Q21.

Question Number:	Answer	Additional Guidance	Mark
	100 (°C) (1)	accept any answer between and including 95 and 102 (possibility that it is not pure water and possibility of heat loss prevents reaching boiling point)	**(1)** AO 2 1

Q22.

Question Number:	Answer	Additional Guidance	Mark
	100 (°C) (1)	accept any answer between and including 95 and 102 (possibility that it is not pure water and possibility of heat loss prevents reaching boiling point)	**(1)** AO 2 1

Q23.

Question number	Answer	Additional guidance	Mark
	statements to include any **two** from use cladding / (extra) insulation (1) use double thicknesses of the concrete (1) use silver / reflective / white (paint) (1) plant trees around (wind break) (1) use double glazed windows (1) (properly) close window(s)/door	 create cavity draft exclusion	**(2) AO1**

Q24.

Question number	Answer	Additional guidance	Mark
	statements to include any **two** from use cladding / (extra) insulation (1) use double thicknesses of the concrete (1) use silver / reflective / white (paint) (1) plant trees around (wind break) (1) use double glazed windows (1) (properly) close window(s)/door	 create cavity draft exclusion	**(2) AO1**

Q25.

Question number	Answer	Mark
	[x] **B** bigger than in water / less than water A is incorrect because the density of steam is less than water. C is incorrect because the space between the particles increases. D is incorrect because the space between the particles increases and density of steam is less than water.	**(1) AO1.1**

Q26.

Question number	Answer	Mark
	[x] **B** bigger than in water / less than water A is incorrect because the density of steam is less than water. C is incorrect because the space between the particles increases. D is incorrect because the space between the particles increases and density of steam is less than water.	**(1) AO1.1**