Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/43**

Paper 4 Extended Theory **October/November 2021**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

[Turn over

Question	Answer	Marks
1(a)	0.0069 m / s^2	**A2**
	(acceleration =) gradient of graph or $\Delta v / \Delta t$ in any form OR $\frac{15-7.5}{(60-42)60}$	C1
1(b)	48 000 m or 48 km	**A3**
	area under graph	C1
	$\frac{1}{2}(18\times7.5\times60)+(7.5\times18\times60)+(15\times40\times60)$	C1
1(c)(i)	(force =) 2.0×10^5 N	**A2**
	(F =) ma OR $2.3 \times 10^7 \times 0.0087$ in any form	C1
1(c)(ii)	there is a backward / drag force OR water resistance	**B1**

Question	Answer	Marks
2(a)	(rate of transfer of gravitational potential energy =) 0.17 W	**A4**
	(gravitational PE lost =) mgh in any form OR $12 \times 10 \times 1.7$	C1
	(gravitational PE lost =) 204 (J)	C1
	(gravitational PE lost / s =) 204 / 1200	C1
2(b)	59% OR 0.59	**A2**
	efficiency = useful power output / power input ($\times$ 100%) in any form OR 0.10 / 0.17 $\times$ 100%	C1
2(c)	any sensible advantage, e.g. no use of (fossil) fuel, no cost to run, can be used in remote areas, no CO_2 / air pollution, no greenhouse gases, does not contribute to global warming	**B1**

Question	Answer	Marks
3(a)(i)		**B2**
	pressure in a liquid increases with depth OR pressure decreases (as bubble rises)	B1
	pressure (of gas) is inversely proportional to volume OR internal pressure greater than external pressure (momentarily) OR (air) molecules do not have to hit surface of bubble as frequently (to stop the bubble collapsing) OR the bubble is not as strongly compressed	B1
3(a)(ii)	$0.50\ cm^3$	**A4**
	PV = constant, in any form	C1
	P (due to water) = ρgh, in any form	C1
	$[1.0 \times 10^5 + (1000 \times 10 \times 3.0)] \times 0.40 = [1.0 \times 10^5 + (1000 \times 10 \times 0.5)] \times V_2$	C1
3(b)		**B2**
	paper is not compressed as much / less force on piston B	B1
	air can be compressed OR some of the energy is used to compress the air (instead of the paper)	B1

Question	Answer	Marks
4		**B4**
	(temperature of air increases) so molecules move faster / their KE increases	B1
	molecules collide with walls of container and change momentum	B1
	greater change of momentum when temperature is higher OR collisions more frequent OR harder collisions OR force = rate of change of momentum	B1
	(higher force and hence) higher pressure	B1

Question	Answer	Marks
5(a)(i)	1.2 kg	**A2**
	$(m =)\frac{7600 \times 0.41}{2600}$ volume constant so mass directly proportional to density	C1
5(a)(ii)	0.37 J / °C	**A2**
	(thermal capacity =) mass × specific heat capacity	C1
5(a)(iii)	48 J	**A2**
	(E =) mcΔT OR 1.2 × 0.50 × (100 – 20) in any form	C1
5(b)	electrons mentioned	**B1**
	(metals have) electrons free to move / delocalised (which transfer thermal energy)	**B1**

Question	Answer	Marks
6(a)		**B5**
	method of producing sound, e.g. clap for echo method or gun for direct measurement, sig gen or loudspeaker, hammer on block	B1
	apparatus used, e.g. stopwatch, long tape, trundle wheel, wall if using echo method, metre rule, microphones and timer or microphones and oscilloscope	B1
	detail of measurement of (long) distance, e.g. measure distance between person and the wall, measure distance between loudspeaker and microphone or measure distance between two microphones	B1
	detail of measurement of time OR appropriate time measured, e.g. at one end start stopwatch when smoke seen from gun and stop it when sound heard, start stopwatch when gun heard / clap heard and stop when echo heard, measure time taken between clap and hearing echo, timer starts when first microphone receives signal and stops when second receives signal OR measurement of wavelength, e.g. move one microphone away until two waves on oscilloscope have moved one wavelength apart	B1
	speed = measured distance / time for direct method OR speed = 2 $\times$ distance from student clapping to wall / time for echo method OR distance between microphones = wavelength AND $v = f \times \lambda$	B1
6(b)		**B2**
	wavelength of light is (much) smaller than width of doorway or wavelength of sound	B1
	wavelength of sound is similar to width of doorway OR $\lambda \simeq$ width of gap for diffraction to occur OR larger wavelength results in greater diffraction ORA	B1

Question	Answer	Marks
7(a)(i)		**B2**
	ray approaching left hand face of prism closer to normal than emerging ray	B1
	ray entering right hand face of prism showing refraction towards normal for ray already drawn	B1
7(a)(ii)	light of single frequency	**B1**
7(b)(i)	$3(.0) \times 10^8$ m / s	**B1**
7(b)(ii)	5.8×10^{14} Hz	**A2**
	(f =) v / λ in any form OR $3.0 \times 10^8 / 5.2 \times 10^{-7}$	C1
7(b)(iii)	2.0×10^8 m / s	**A2**
	refractive index = speed of light in air / speed of light in glass in any form	C1

Question	Answer	Marks
8(a)		**B2**
	five straight, parallel vertical lines, equally spaced by eye, between plates	B1
	arrow head pointing upwards on at least one line and none wrong	B1
8(b)(i)	11 A	**A2**
	(I =) P / V in any form OR 2400 = I220	C1
8(b)(ii)	9900 C OR 9800 C	**A2**
	(Q =) It in any form OR (Q =) $11 \times 15 \times 60$	C1
8(b)(iii)	13 A	**B1**

Question	Answer	Marks
9(a)(i)		**B2**
	four components joined in series	B1
	all circuit symbols correct for resistor, thermistor, a filament lamp and a power supply	B1
9(a)(ii)	voltmeter connected in parallel to the resistor	**B1**
9(a)(iii)	(p.d. across terminals of power supply) = 18 V	**A4**
	(current through resistor when p.d. across it is 6.0 V =) 0.4 A	C1
	current same through all components in series circuit OR horizontal line through 0.4 A on graph through all three curves OR p.d. across filament lamp = 3.0 V OR p.d. across thermistor = 9.0 V	C1
	p.d. across filament lamp = 3.0 V AND p.d, across thermistor = 9.0 V	C1
9(b)	any sensible use requiring temperature control or depending on temperature, e.g. fire alarms, to keep computers cool (by operating fan), in incubators, electronic thermometer, electronic thermostat in kettle / car engine	**B1**

Question	Answer	Marks
10(a)(i)	6.0 V	**A2**
	(V_S =) $N_S V_P$ / N_P in any form or (V_S =) (25 × 120) / 500	C1
10(a)(ii)	2.5 A OR 2500 mA	**A2**
	(I_S =) I_P V_P / V_S in any form OR (0.125 × 120) / 6.0	C1
10(b)(i)	arrow right to left along loose part of wire or any other correct position	**B1**
10(b)(ii)		**B2**
	wire moves up	B1
	(reversing direction of the current) reverses the direction of force	B1
10(c)	coil does not continue to rotate in the same direction	**B1**

Question	Answer	Marks
11(a)(i)	background radiation OR any reasonable specific source of background radiation e.g. cosmic rays, the sun, space, building materials, earth, rocks, radon gas, student etc.	**B1**
11(a)(ii)	(radioactive decay is a) random (process)	**B1**
11(b)		**B3**
	U: proton no 92 and nucleon number 238	B1
	Th: proton number 90 and nucleon number 234	B1
	α: proton number 2 and nucleon number 4	B1
11(c)	11	**A2**
	three half lives or evidence of multiplying half-life by 3	C1