



Cambridge IGCSE™

PHYSICS

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Paper 4 Extended Theory

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MARK SCHEME

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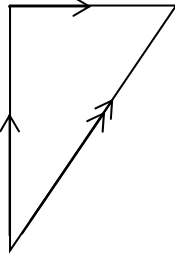
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This document consists of **18** printed pages.

Question	Answer	Marks
1(a)	it / a vector has a direction	B1
1(b)	two / three vectors and no more than one other quantity underlined	C1
	acceleration and momentum and velocity underlined and no others	A1
1(c)(i)	5.5 N	B1
1(c)(ii)	correct right-angled triangle / rectangle / intersecting arcs seen e.g. 	B1
	(magnitude from) 9.6 to 10.0 N	B1
	(angle to vertical from) 54.0 to 57.5°	B1
1(c)(iii)	any two of: equal (in magnitude) opposite (in direction) the ring is in equilibrium or no resultant force on ring or forces on ring balance	B2

Question	Answer	Marks
2(a)	(quantity of thermal) energy or energy (to increase temperature) or energy (transferred by heating)	C1
	energy to increase temperature (of an object) per degree Celsius 1 °C	A1
2(b)(i)	(internal energy) depends on kinetic energy (of molecules)	B1
	kinetic energy (of molecules) decreases or potential energy (of molecules) decreases	B1
2(b)(ii)	$(\Delta E =) mc\Delta T$ in any form or $0.24 \times 4200 \times 17$	C1
	1.7×10^4 J	A1
2(c)(i)	k.e. of <u>molecules</u> / (thermal) energy absorbed (from water / surroundings) or energy absorbed from (cooling) water	B1
	supplies latent heat or energy used to overcome intermolecular forces / to break bonds	B1
2(c)(ii)	any determination of mass	B1
	determine change in mass (of ice) / increase in mass of water or dry the ice or ensure water is at 0 °C / equilibrium is established or insulate the beaker	B1
	use ($t =$) E / m in any form	B1

Question	Answer	Marks
3(a)	any three of: they / molecules collide with inner surface momentum (of a molecule) changes / reverses force exerted / impulse force spread over area / surface or $p = F / A$	B3
3(b)(i)	$(V_2 =) p_1 V_1 / p_2$ in any form or $630 \times 1.0 \times 10^5 / 1.4 \times 10^5$	C1
	450 cm ³ or 4.5×10^{-4} cm ³ or 0.45 dm ³	A1
3(b)(ii)	any two of: <u>molecules</u> move more slowly / have less kinetic energy pressure (inside balloon) decreases or pressure is directly proportional to temperature or $p \propto T$ volume is directly proportional to temperature or $V \propto T$ molecular collisions less frequent molecular collisions less violent / hard / exert smaller impulse water / external pressure compresses balloon or water pressure greater (and balloon compressed)	B2

Question	Answer	Marks
4(a)(i)	straight line begins at (15 s, 120 m) and continues to end of given line	B1
4(a)(ii)	curve with increasing gradient from origin to beginning of candidate's (a)(i)	B1
4(b)	$(E_k =) \frac{1}{2}mv^2$ in any form	C1
	$\frac{1}{2} \times 1.8 \times 10^5 \times 20^2$	C1
	3.6×10^7 J	A1
4(c)(i)	(work done =) force $\times$ distance (moved in the direction of the force)	C1
	(work done =) force $\times$ distance moved in the direction of the force	A1
4(c)(ii)	240 m c.a.o.	B1
4(c)(iii)	3.6×10^7 / 240 or <u>kinetic energy</u> / distance or ($a =$) 20 / 24 or $\Delta v / t$ in any form or 0.83 or ($F =$) ma in any form	C1
	1.5×10^5 N	A1

Question	Answer	Marks
5(a)	(point) where (parallel) rays (of light) meet (after passing through lens)	C1
	point) where parallel rays (of light) meet / are focussed (after passing through lens) or (point) through which rays (of light) that emerge parallel pass (before reaching lens)	A1
5(b)	distance between principal focus / focal point and optical centre / lens	B1
5(c)(i)	vertical line labelled L 4.0 (± 0.2) cm to the right of O	B1
5(c)(ii)	paraxial ray from tip of O to candidate's lens and from lens to tip of I or paraxial ray from lens to tip of I and from tip of O to candidate's lens	C1
	3.0 (± 0.2) cm	A1
5(c)(iii)	fourth box ticked i.e: 	B1
	reversed / inverted	B1

Question	Answer	Marks
6(a)(i)	(J) ultraviolet (radiation) (K) infrared (radiation) (L) radio (waves)	
	two correct	C1
	all three correct	A1
6(a)(ii)	L or radio (waves)	B1
6(b)	(c =) 3.0×10^8 (m / s) seen	C1
	(f =) v / λ in any form or $3.0 \times 10^8 / 1.2 \times 10^{-9}$	C1
	2.5×10^{17} Hz	A1
6(c)(i)	stated <u>medical</u> use (e.g. treating cancer / X-ray shadowgraph / sterilising equipment)	B1
	statement of what happens to the X-rays (e.g. absorbed by tumour / bones / bacteria)	B1
	stated consequence (e.g. tumour killed or image / picture / shadow / photograph produced)	B1
6(c)(ii)	can cause burns / (cell) mutation / cell damage / tumours / cancer / damages DNA etc.	B1

Question	Answer		Marks
7(a)	electrons mentioned		B1
	negative charges / electrons move from cloth or move to rod		
7(b)(i)	electrons / negative charge(s) repelled to earth or ball charged by induction		B1
	ball positively charged		B1
	opposite charges attract		B1
7(b)(ii)	negatively charged (by rod)	or	B1
	repelled by rod	or	
			B1

Question	Answer	Marks
8(a)	Q / t or (rate of) flow of (electric) charge / electrons	B1
8(b)	(current in the $450\ \Omega$ resistor =) $I_2 - I_1$	B1
8(c)	($V_{450\ \Omega} =$) IR or 0.012×450 or 5.4 (V) or $9.0 - 5.4$ or 3.6 (V) seen	C1
	($I =$) $3.6 / 800$ or 0.0045 (A)	C1
	($P =$) VI or 3.6×0.0045 or $3.6^2 / 800$	C1
	1.6×10^{-2} W or 16 mW	A1
8(d)	resistance (of LDR) decreases	B1
	current (in circuit) increases or resistance of parallel pair decreases	C1
	p.d. across $800\ \Omega$ resistor increases and p.d. across $450\ \Omega$ resistor decreases or resistance of parallel pair a smaller fraction of total resistance and p.d. across $450\ \Omega$ resistor decreases	A1

Question	Answer	Marks
9(a)	(very small) nucleus and surrounded by electrons (in orbit / shells)	B1
	92 protons or 92 electrons or number of protons = number of electrons	B1
	protons and neutrons in nucleus	B1
	143 neutrons	B1
9(b)	(uranium-238 has) three more neutrons (in nucleus)	B1
9(c)	${}^{94}_{38}\text{(E)}$	B1
	${}^{94}_{38}\text{(E)}$	B1
9(d)(i)	55	B1
9(d)(ii)	140	B1