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O Level

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PHYSICS **5054/22**

Paper 2 Theory **May/June 2017**

MARK SCHEME

Maximum Mark: 75

Published

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Question	Answer	Marks
1(a)((i)	(a=) v(–u) / t **or** 25 / 14	**C1**
	1.8 m / s^2	**A1**
1(a)(ii)	initial straight line from (0,0) to (14,25)	**B1**
	gradient of line decreases after 14 s **and** flat from (70,55) to (80,55)	**B1**
1(b)	force backwards on driver / car B1	**any 3**
	force produced by seat belt / steering wheel **or** friction <u>with seat</u> / friction <u>between tyres and road</u> B1	
	no / small (backward) force / friction on bag B1	**B3**
	(mass of bag) resists change (from state of motion) **or** carries on in straight line **or** has constant velocity **or** (bag) has inertia B1	

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Question	Answer	Marks
2(a)	use of stopwatch or electronic timer	**B1**
	time at least 5 swings **and** divide by number of swings **or** use of fiducial mark **or** definition of one swing clear e.g. A to C to A or from A and back to A	**B1**
2(b)(i)	(m=) P.E. / gh **or** 240 / 10 × 0.6	**C1**
	40 kg	**A1**
2(b)(ii)	air resistance **or** friction (with air or rope and tree)	**B1**
	heat produced / work done (in / against air or friction) **or** effect of wind **or** work done by arms / legs	**B1**

Question	Answer	Marks
3(a)	force × distance **ignore** force into distance	**C1**
	force × **perpendicular** distance (from line of action to point / pivot)	**A1**
3(b)	any moment calculation seen, e.g. F × 22 = 80 × 4	**C1**
	15 N	**A1**
3(c)	(P=) force / area **or** 80 / 0.0012	**C1**
	6.7×10^4 Pa	**A1**

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Question	Answer	Marks
4(a)	(c=) E / mT **or** 17000 / (22 × 850)	**C1**
	0.91 J / (g °C)	**A1**
4(b)	765 – 774 J / °C	**B1**
4(c)	molecules colliding against molecules **or** movement / diffusion / collision of (free) electrons	**B1**

Question	Answer	Marks
5(a)	irregular arrangement of at least 8 molecules with at least one molecule touching other	**B1**
5(b)	solid – vibrate (about fixed positions)	**B1**
	liquid – change position / slide (over each other) **or** move / translate throughout (liquid) **or** move in clusters	**B1**
	gas – random movement **or** move in all directions **or** high speed / kinetic energy **or** have range of speeds **or** move throughout container **or** move in a straight line (between collisions) **or** move freely	**B1**
5(c)	no / weak force between molecules in gases **or** molecules not held together in gases	**B1**
	speed / K.E of gas molecules fast(er) than solids	**B1**

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Question	Answer	Marks
6(a)	longitudinal - vibration / oscillation / movement to and fro **and** in direction of wave **or** has compressions and rarefactions	**B1**
	transverse – vibration / oscillation / movement up and down **and** at right angles to wave **or** has crests and troughs	**B1**
6(b)(i)	(λ =) v / f or 330 / 3800	**B1**
	0.087 m **or** 8.7 cm	**B1**
6(b)(ii)	not heard **and** because below the range of audible frequencies **or** audible range is 20 – 20 000 Hz **or** too low a pitch / frequency	**B1**

Question	Answer	Marks
7(a)(i)	current in coil (at right angles) in a magnetic field (of magnet) **or** left-hand rule mentioned	**B1**
7(a)(ii)	reverses / changes direction of current (in coil)	**B1**
	reverses current every half turn / when coil is vertical **or** reverses forces (on side AB / CD) **or** keeps forces in same direction for wire on one side	**B1**
7(b)(i)	(E =)VIt or 2 × 12 × 8 **or** E = Pt **and** P = VI **or** E = VQ **and** Q = It	**C1**
	190 **or** 192 J	**A1**
7(b)(ii)	73% **or** 0.73	**B1**

Question	Answer	Marks
8(a)	equal (numbers of) positive and negative charges	**B1**
8(b)(i)	negative charge moves from cloth to rod	**C1**
	electrons move from cloth to rod	**A1**
8(b)(ii)	apparatus needed, e.g. (small) pieces of paper / water stream / (gold leaf) electroscope / suspended or pivoted other charged rod / charged object / conducting object	**B1**
	correct statement of what is seen / felt with apparatus	**B1**

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SECTION B

Question	Answer	Marks
9(a)(i)	ray from right-hand corner of mirror to eye	**B1**
	any incident and corresponding reflected ray correct by eye	**B1**
9(a)(ii)	normal drawn at any intersection of incident and reflected ray	**C1**
	both *r* and *i* labelled correctly with normal	**A1**
9(a)(iii)1	cannot be formed on a screen **or** nothing at the image (position)	**B1**
	rays do not come (all the way) from the image **or** rays only appear to come from image	**B1**
9(a)(iii)2	(same distance) behind the mirror **or** same size (as object) **or** upright / erect **or laterally** inverted	**B1**
9(b)(i)	reflection in mirror occurs at any angle **or** total internal reflection (TIR) only occurs for *i* > critical angle **or** there is no critical angle for the mirror B1	**any 2** **B2**
	TIR occurs from dense to less dense medium **or** in the dense(r) medium **or** from glass to air **or** inside / does not escape glass **or** from slow to fast (media) **or** mirror reflection from air to glass B1	
	(mirror) reflection is not total, e.g., not all reflected **or** better quality of image **or** multiple images from a mirror B1	

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Question	Answer	Marks
9(b)(ii)	(n=) 1 / sinC **or** 1 / sin44	**C1**
	1.4	**A1**
9(b)(iii)	n = sini / sinr in any form, e.g. sinr = sin50 / n	**C1**
	32° – 33°	**A1**
9(b)(iv)	ANY 2 lines from • more data per second **or** per unit time • less decrease in strength / amplitude / attenuation • less heat / power produced / wasted • less need for repeating or amplification stations • less interference **/** noise • more secure / less chance of cross-talk • lighter / less heavy	**B1** **B1**

Question	Answer	Marks
10(a)(i)	directly proportional	**B1**
10(a)(ii)	straight line **or** does not curve **or** constant gradient	**B1**
10(a)(iii)1	greater **or** twice as large	**B1**
10(a)(iii)2	straight line with half the gradient	**B1**
10(b)(i)1	$1 / R_t = 1 / R_1 + 1 / R_2$ in any form e.g. $1 / R = 1 / 20 + 1 / 80$ **or** 16 (Ω) seen	**C1**
	40 Ω	**A1**
10(b)(i)2	(I=)V / R in any form e.g. 6 / 40	**C1**
	0.15 A	**A1**
10(b)(i)3	0.15 × 16 **or** 0.15 × 24 **or** 3.6 (V) seen **or** current split in ratio 1:4, e.g. 0.03 A and 0.12 A seen **or** clear attempt at potential divider formula	**C1**
	2.4 V	**A1**
10(b)(ii)1	work done ÷ charge	**B1**
10(b)(ii)2	correct circuit symbol for a cell and positive correct	**B1**
	four cells, correct symbol, correctly in series	**B1**
10(b)(ii)3	four cells in series and another four in parallel **or** any other series and parallel arrangement of 8 cells with connections to and from battery	**B1**
10(c)	lasts longer **or** if one cell fails it still works **or** contains more energy	**B1**

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Question	Answer	Marks
11(a)(i)	rocks / soil / Earth's surface / building materials / radon (gas) / waste from a nuclear power station / weapons testing	**B1**
11(a)(ii)	cancer / mutation / cell damage / gene damage **or** adds to / affects experimental readings / count rate **or** causes ionisation	**B1**
11(a)(iii)	protons 2	**B1**
	neutrons 2	**B1**
11(a)(iv)	alpha-particles absorbed / stopped by / cannot penetrate air / atmosphere **or** scattered (by air) **or** cause ionisation (and slow down)	**B1**
11(a)(v)	continuous curve deflected either clockwise **or** anticlockwise within shaded area	**B1**
	arrow or other indication to show anticlockwise deviation within shaded area	**B1**
11(b)(i)	time taken to halve	**C1**
	time taken for the activity / count (rate) / number of atoms / number of nuclei to halve	**A1**
11(b)(ii)	any halving seen, e.g. 200–100 **or** 3 half lives	**B1**
	17 100 years	**B1**
11(b)(iii)	too little carbon-14 left **or** all decayed **or** shows large reduction	**B1**
11(c)(i)	different number of neutrons **or** different mass **or** different nucleon number	**C1**
	carbon-14 has two more neutrons	**A1**
11(c)(ii)	same number of protons	**B1**

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