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**PHYSICS**

**5054/22**

Paper 2 Theory

**October/November 2017**

MARK SCHEME

Maximum Mark: 75

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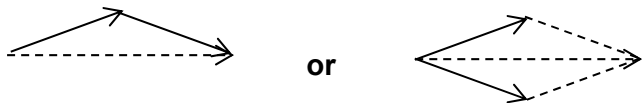
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Question	Answer	Marks
1(a)	scale at least: 1.0 cm : 10 kN	<b>B1</b>
	correct triangle <b>or</b> correct parallelogram <b>and</b> resultant, i.e. 	<b>B1</b>
	90 kN ≤ resultant ≤ 94 kN	<b>B1</b>
1(b)	no <u>resultant</u> force <b>or</b> balanced forces <b>or</b> all forces cancel	<b>B1</b>
	(force of tugboats cancelled) by drag/water resistance/water friction etc.	<b>B1</b>

Question	Answer	Marks
2(a)	shape	<b>B1</b>
	size / volume / density	<b>B1</b>
2(b)(i)	0.12 N	<b>B1</b>
2(b)(ii)	<u>weight</u> of first spring (increases extension) <b>or</b> <u>weight</u> of first spring (takes spring beyond the limit of proportionality)	<b>B1</b>
2(b)(iii)	where / point / load / extension / limit beyond which the extension is not directly proportional to load / extension-load graph is not straight	<b>B1</b>
2(c)(i)	elastic potential energy	<b>B1</b>
2(c)(ii)	friction / air resistance mentioned <b>or</b> thermal energy / heat produced	<b>B1</b>

Question	Answer	Marks
3(a)	$(P =) F/A$ or $240/(0.44 \times 0.21)$ or $240/0.092(4)$	<b>C1</b>
	$2.6 \times 10^3 \text{ Pa}$	<b>A1</b>
3(b)	atmospheric pressure (is acting on the block/ground)	<b>B1</b>
3(c)(i)	0.065 m or 6.5 cm or 65 mm	<b>B1</b>
3(c)(ii)	<b>two</b> separate approaches I/II	
	I centre of mass rises	<b>B1</b>
	gravitational potential energy gained	<b>B1</b>
	or II block has weight	<b>B1</b>
	force <b>moves</b> or something moves in direction of force or force makes block move/rotate	<b>B1</b>

Question	Answer	Marks
4(a)(i)	$(E =) Pt$ or $75 \times 63$ or $75 \times 63 \times 60$	<b>C1</b>
	$75 \times 63 \times 60 \times 60$ or $2.835 \times 10^5$ or $0.075 \times 63$	<b>C1</b>
	$1.7 \times 10^7 \text{ J}$	<b>A1</b>
4(a)(ii)	$2.0 \times 10^6 \text{ J}$	<b>B1</b>
4(b)(i)	non-renewable <b>and</b> gets used up / not replaced / will run out / finite	<b>B1</b>
4(b)(ii)	<b>three</b> separate approaches I / II / III	
	I greenhouse gases / CO / CO <sub>2</sub> emitted	<b>B1</b>
	global warming / <u>increase</u> greenhouse effect / ice caps melt	<b>B1</b>
	<b>or</b> II acid rain / NO <sub>x</sub> / SO <sub>2</sub> emitted	<b>B1</b>
	breathing difficulty / damage to buildings / acidify lakes <b>or</b> damages / kills plants / sea-life / animals / fish	<b>B1</b>
	<b>or</b> III oil spills	<b>B1</b>
damages / kills plants / sea-life / animals / fish	<b>B1</b>	

Question	Answer	Marks
5(a)	joining together of (small) <u>nuclei</u> (to make bigger nuclei)	<b>B1</b>
	energy released	<b>B1</b>
	hydrogen (used) <b>or</b> helium (produced)	<b>B1</b>
5(b)	electromagnetic <u>radiation</u> / infra-red / light / ultraviolet	<b>B1</b>
	travels through vacuum <b>or</b> no medium needed	<b>B1</b>

Question	Answer	Marks
6(a)	reflection of <u>sound</u>	<b>B1</b>
6(b)(i)	decreases	<b>B1</b>
6(b)(ii)	does not change	<b>B1</b>
6(c)	$(\lambda =) c/f$ <b>or</b> 330/3700	<b>C1</b>
	0.089 m <b>or</b> 8.9 cm <b>or</b> 89 mm	<b>A1</b>

Question	Answer	Marks
7(a)(i)	$1/R = 1/R_1 + 1/R_2$ or $R_1R_2/(R_1 + R_2)$ or $1/R = 1/1800 + 1/9000$ or $9000 \times 1800/10\ 800$ or 0.00066667	<b>C1</b>
	1500 $\Omega$	<b>A1</b>
7(a)(ii)	$(I =) V/R$ or 4.5/1500	<b>C1</b>
	0.0030 A or $3.0 \times 10^{-3}$ A or 3.0 mA	<b>A1</b>
7(b)(i)	increases <b>and</b> resistance of LDR decreases	<b>B1</b>
7(b)(ii)	does not change <b>and</b> resistance / e.m.f. does not change / not affected by LDR	<b>B1</b>

Question	Answer	Marks
8(a)	$(Q =) It$ or $120 \times 3.5$	<b>C1</b>
	420 C	<b>A1</b>
8(b)	(small current) magnetises something physical or produces a magnetic field or produces an electromagnet	<b>M1</b>
	(terminals of motor) switch/contacts/terminals (in first circuit) attract/close	<b>A1</b>

Question	Answer	Marks
9(a)(i)	$(F =) ma$ <b>or</b> $160 \times 0.35$	<b>C1</b>
	56 N	<b>A1</b>
9(a)(ii)	$(v = u +) at$ <b>or</b> $0.35 \times 1.2$	<b>C1</b>
	0.42 m/s	<b>A1</b>
9(b)(i)	straight line of positive gradient from origin to $t = 1.2$ s	<b>B1</b>
	horizontal line after $t = 1.2$ s	<b>B1</b>
9(b)(ii)	area mentioned	<b>B1</b>
	area <u>under</u> the line <b>or</b> convert $\text{cm}^2$ (of graph paper) to distance <b>or</b> in terms of the scales	<b>B1</b>
9(c)(i)	<b>1</b> arrow from space-station towards centre of Earth	<b>B1</b>
	<b>2</b> gravitational field / attraction	<b>B1</b>
	of Earth	<b>B1</b>
9(c)(ii)	<b>two</b> separate approaches	
	<b>I</b> change of displacement	<b>M1</b>
	per unit time <b>or</b> divided by time	<b>A1</b>
	<b>or</b> <b>II</b> rate of change of distance <b>or</b> distance moved per unit time	<b>M1</b>
	in specified direction	<b>A1</b>
9(c)(iii)	<b>1</b> (it / velocity) changes <b>and</b> (because its) direction changes / force perpendicular to velocity	<b>B1</b>
	<b>2</b> (remains) constant <b>and</b> depends on speed / g.p.e. remains constant / (k.e.) is a scalar quantity / speed is constant	<b>B1</b>

Question	Answer	Marks
10(a)(i)	$(I =) P/V$ or 2.8/230 or 2800/230	C1
	0.012 or 12	C1
	12 A	A1
10(a)(ii)	12 A < integral number of amperes < 20 A	B1
10(b)(i)	$(Q =) m\Delta Tc$ or $6.3 \times (49 - 23) \times 4200$ or $6.3 \times 26 \times 4200$	C1
	$6.9 \times 10^5$ J	A1
10(b)(ii)	<u>more thermal</u> energy is lost (per unit time)	B1



Question	Answer	Marks
10(c)(i)	(when heated) water expands / volume of water increases / water becomes less dense	<b>B1</b>
	heated water / water with more energetic particles rises	<b>B1</b>
	cooler / denser water sinks <b>or</b> circulation <b>or</b> convection current	<b>B1</b>
10(c)(ii)	<b>two</b> separate approaches <b>I / II</b>	
	<b>I</b> atoms / molecules / ions / particles vibrate (more violently)	<b>B1</b>
	collide with neighbouring atoms / molecules / ions / particles	<b>B1</b>
	energy / heat / vibration passed on (to neighbour)	<b>B1</b>
	<b>or</b> <b>II</b> particles / atoms / molecules / ions vibrate (more violently)	<b>B1</b>
	atoms / molecules / ions / particles strike electrons	<b>B1</b>
	electrons travel through transporting energy / heat	<b>B1</b>
10(c)(iii)	<u>particles / molecules / atoms</u> move apart (on average)	<b>B1</b>
	volume increases <b>and</b> density decreases	<b>B1</b>

Question	Answer	Marks
11(a)(i)	steel	<b>B1</b> <b>B1</b>
11(a)(ii)	iron	
11(a)(iii)	iron B1 <b>(i)</b> and <b>(iii)</b> both correct B1 <b>(ii)</b> correct	
11(b)(i)	clear use (e.g. change voltage / current)	<b>M1</b>
	detail of operation (to transmit electricity <b>or</b> in a charger etc.)	<b>A1</b>
11(b)(ii)	<b>1</b> <i>voltage</i> on vertical axis <b>and</b> <i>time</i> on horizontal axis	<b>B1</b>
	clear attempt at sinusoidal curve for at least one cycle	<b>B1</b>
	<b>2</b> ( $V_S =$ ) $V_P N_S / N_P$ <b>or</b> $220 \times 85 / 1700$	<b>C1</b>
	11 V	<b>A1</b>
11(c)(i)	<b>1</b> <u>magnetic field</u> / flux / flux linkage mentioned	<b>B1</b>
	magnetic field (lines) cut solenoid <b>or</b> v.v. <b>or</b> changing (magnetic) field / flux / flux linkage (in solenoid)	<b>B1</b>
	<u>induced</u> e.m.f. / voltage	<b>B1</b>
	<b>2</b> it / current magnetises solenoid / produces magnetic field / flux(linkage) in solenoid / <u>produces</u> a S-pole (in solenoid)	<b>B1</b>
	magnet repelled <b>or</b> experiences a force to the left	<b>B1</b>
11(c)(ii)	smaller reading / deflection	<b>B1</b>
	reading in opposite direction	<b>B1</b>