CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the May/June 2015 series

5054 PHYSICS

5054/22 Paper 2 (Theory), maximum raw mark 75

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1	(a)			weight (pulls spring down and causes tension) **or** force/pull of **gravity** **or** mass is in gravitational field	B1
	(b)			has a direction	B1
	(c)	(i)	1	$l = l_0 + e$ **or** $l_0 = l - e$ **or** $e = l - l_0$	B1
			2	36 cm	B1
		(ii)		curve upwards after 10 N	B1
2	(a)			tape	B1
	(b)	(i)		mass ÷ volume **or** mass per unit volume	B1
		(ii)		(V=) 15 × 0.25 × 2 or 7.5 seen 2400 kg / m^3	C1 A1
		(iii)		(A=) 15 × 0.25 **or** 3.75 **or** (P=) F / A **or** (P=) 18 0000 / A **or** (P=) *dgh* / ρgh seen 48 000 Pa	C1 A1
		(iv)		(length doubles) so both area **and** weight / force double **or** area **and** force / weight both increase / large**r** (in proportion) **or** height **and** density the same (in $P = dgh$)	B1
3	(a)	(i)		(efficiency =) useful energy ÷ input energy **or** 95 000/120 000 (×100) 0.79(17) **or** 79(.17)**%**	C1 A1
		(ii)		(P=) energy/time **or** 90 000 / 60 1500 W	C1 A1
	(b)			electric kettle **and** • **more** energy / heat **per minute** output / into water / supplied • more power output transfers heat / energy faster / at a faster rate	B1
	(c)			steam molecules have more potential energy; further apart; smaller force / bonds between molecules; have latent heat; more random arrangement	B1
4	(a)			(H=) *mcT* **or** 330 × 4.2 × 13 18 000 J **or** 18 020 **J or** 18 018 J	C1 A1

	(b)		ice takes in / needs heat / energy • for latent heat • to melt / turn to water (at 0 °C) / change state • to break bonds / for molecules to gain P.E.	B1
			water (in jug initially at 0 °C) warms up **or** ice (and melted water in jug) • stays at 0 °C / stays cold / stays at constant temp. • gives larger temperature difference (between liquid and melting ice in jug)	B1
	(c)		metal is a good conductor (of heat) **or** metal / can has lower heat capacity allow opposite statements for plastic, e.g. plastic is an insulator (of heat), penalise wrong statements and Physics, e.g. liquid evaporates from can, metals conduct temperature / convect better	B1
5	**(a)**		negative charge moves from hair / person / head to balloon electrons move from hair / person / head to the balloon	C1 A1
	(b)		hair is positive (at end) opposite charges attract **or** positive and negative attract	B1 B1
	(c)		**charges / electrons** • don't flow away • aren't conducted (to earth / person) stay on balloon / on insulator	B1
	(d)		any sensible example e.g. photocopier, electrostatic precipitator, flu ash removal, spray painting, printing, crop spraying, lightning fixes nitrogen in atmosphere etc.	B1
6	**(a)**	**(i)**	mention of (magnetic) field / flux (of N and S-poles) (coil/wire) cuts **magnetic** field / flux / lines **or magnetic** flux **in coil** changes	C1 A1
		(ii)	(one side of) coil cuts one way and then the other **or** (side) moves one way and then the other / returns **or** flux increases and then decreases	B1
	(b)		increase in emf for both stronger magnets and more turns no change / same frequency for both stronger magnets and more turns increase and increase for turn the coil faster	B1 B1 B1

7 **(a)** to provide a complete circuit (with live) B1
or to pass current back to mains
or provide a return path for the current

(b) current / charge / electrons flow to earth / earth wire / ground (when live touches case) B1
fuse melts / blows **and** disconnects circuit / cuts live / stops current B1

(c) doubly insulated B1
or case / body made of plastic / insulator / not made of metal
or user cannot touch metal

(d) (circuit breaker) B1
- turns off / acts fast(er)
- can be reset
- easy to see it has tripped / switched
- can detect small difference between live and neutral currents / small (leakage) current to earth

8 **(a)** left column both 1 B1
right column 0 **and** 1 B1

(b) (at least one of the atoms) contain same number of electrons and protons B1
or have 1 electron and 1 proton
charge on electron and proton opposite B1
or electron negative **and** proton positive
or charge on electron neutralises/cancels/balances proton charge
neutrons have no charge B1

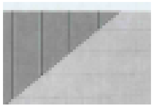
9 **(a)** number of waves (that pass a point) M1
or number of oscillations (passing a point)
in unit time **or** per second **or** in 1 second A1

(b) **(i)** 1.5 cm B1

(ii) (v =)$f\lambda$ **or** 5 × 1.5 seen C1
or (s=)d / t **and** f = 1 / t
7.5 cm / s A1

(c) **(i)** wavelength decreases B1
travels a shorter distance in the same time B1
or frequency stays the same (and $v = f\lambda$)

(ii) wavefronts with smaller wavelength (by eye) B1
smaller angle to surface (by eye) **and** slanted down B1
wavefronts join those in shallow water B1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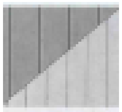
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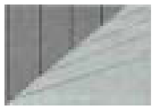
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(d) (i)

sound	water
particles / wave / source • vibrate / oscillate / move in direction of (travel of) wave / along wave • move backwards and forwards	particles / wave / source • vibrate / oscillate / move at 90º to direction of (travel of) wave • move up and down
(contains) compressions and rarefactions **or** particles come closer / further apart	(contains) crests and troughs
speed 300–330 m / s	wave slower (than sound)

B1
B1
one row only

(ii) method of generating sound, e.g. (loud) speaker (and signal generator) B1
apparatus that enables refraction clear, e.g. carbon dioxide in balloon or any shape where refraction is possible B1
method of detecting refraction, e.g. microphone and how it is used to show refraction B1

10 (a) (i) 1 S-pole on right of core B1

2 N-pole anywhere on vertical section of armature B1
and S-pole anywhere on horizontal section of armature
or
N-pole on left of vertical section of armature **and** S-pole on right

(ii) poles (on core) reverse / change positions B1
(armature still) attracted (to core) B1

(iii) (iron is a) temporary magnet B1
or (iron) easily demagnetised
or steel retains magnetism
when current off / no battery / switch off / circuit open B1
and
armature released / does not stay attracted / opens connections (at AB)

(b)	**(i)**		thermistor	B1
	(ii)		resistance (of X) decreases	B1
			current (in coil) increases **or** more voltage across coil	B1
			and	
			either relay switch closes **or** circuit (to bell) complete	
	(iii)	**1**	(V=) IR **or** 1.5 ($\times 10^{-3}$) $\times$ 2000	C1
			3(.0) V	A1
		2	9(.0) V	B1
		3	12/200 **or** 0.06 (A) **or** 60 (mA) seen	C1
			or (R_T =) 195(.12 Ω)	
			61(.5) mA **or** 0.061(5) A **or** 62 mA **or** 0.062 A	A1
	(iv)		light dependent resistor **or** LDR	B1

11	**(a)**	**(i)**		distance (travelled) per second **or** speed	C1
				distance (travelled) per second / speed in a given direction	A1
				or displacement / time	
				or change in displacement per unit time	
				or displacement (travelled/covered) per unit time	
				or rate of change of displacement	
		(ii)		opposite direction	B1
		(iii)	**1**	value seen for v and corresponding value of t	C1
				$0 < t \leqslant 1.4$ and $0 < v \leqslant 14$	
				(a=) v-u / t algebraic or numerical equation	C1
				10 m / s^2	A1
			2	sensible comment	A1
		(iv)	**1**	4(.0 s)	B1
			2	weight **or** force due to gravity mentioned (at D)	B1
				mention of	B1
				• upwards force (on man) from cord	
				• tension / elastic force from cord (on man)	
				force in cord / upward force / tension greater than downwards force	B1
				or resultant force upwards	
	(b)	**(i)**		5000	B1
				20 000	B1
		(ii)		(h =) PE / mg **or** 5000 **=** 50 $\times$ 10 $\times$ h	C1
				10 m	A1