CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the October/November 2015 series

5054 PHYSICS

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

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.

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Section A

1	(a)	(V =)m/ρ **or** 10 600 / 6500 / 4100 / 2400 ÷ 1000 **or** 6.5 **or** 4.1		C1	
		2.4 m^3 / 2.4 × 10^6 cm^3		A1	
	(b)	(i)	fuel / chemical (potential energy)	B1	
		(ii)	some to heat / thermal (energy)	B1	
			some to kinetic (energy of air **or** tractor)	B1	
	(c)	(GPE =) mgh **or** 2400 × 10 × 850		C1	
		2.0 / 2.04 × 10^7 J		A1	[7]
2	(a)	any **two** from different lines of: distort / stretch / change in shape / squeezed / bends / deforms compresses / change in size / volume / density / depth / height change in temperature / gets hot(ter) / generates heat		B2	
	(b)	(i)	straight line from origin	B1	
			upward curve labelled / clear from limit of proportionality	B1	
		(ii)	permanent extension **or** spring is longer than it was originally	B1	[5]
3	(a)	(p =)$h\rho g$ **or** 32 × 1000 × 10		C1	
		3.2 × 10^5 Pa		A1	
	(b)	(i)	atmospheric pressure (is also acting on the surface of the water)	B1	
		(ii)	(F =)pA **or** 4.2 × 10^5 × 45 **or** 3.2 × 10^5 × 45 **or** 1.44 × 10^7	C1	
			1.9 / 1.89 × 10^7 N	A1	
	(c)	(vector) has a direction **or** scalar does not have a direction **or** (vectors) may cancel **or** scalars cannot cancel		B1	[6]
4	(a)	wood is a poor / not a conductor **or** (good) insulator (of heat)		B1	
	(b)	(i)	vibrating atoms / ions / particles / molecules **or** electrons gain energy	B1	
			atoms / ions / particles / molecules hit free electrons **or** electrons travel (a long distance through the copper / saucepan)	B1	
			electrons hit / transfer energy to (distant) atoms / ions / molecules / particles	B1	
		(ii)	hot / heated water expands / is less dense	B1	
			hot / heated water / less dense water rises	B1	
			(sets up) circulation / convection (current) **or** cold water sinks	B1	[7]

5	(a)	(i)	(the property) varies **with temperature**	B1	
		(ii)	any **two** from: volume (of gas / liquid) **or** density **or** length (of thread) voltage **or** current **or** e.m.f. resistance pressure (of gas) colour (quantity of) radiation emitted liquid crystal structure	B2	
	(b)	(i)	**temperature** of melting ice / where water freezes **or** water / ice mixture	B1	
		(ii)	immerse thermometer in melting ice / at the ice point **or** boiling water / at steam point **or** ice point **and** steam point marked / found (may be implied) divide the difference into 100 units / sections	B1 B1	[6]
6	(a)		they / molecules move / collide faster **or** gain kinetic energy they / molecules collide **with walls** more often **or** harder	B1 B1	
	(b)		pressure decreases larger volume (of gas) **or** they / molecules move further between collisions fewer collisions **per unit time** / reduced collision frequency (of molecules with wall) **or** collide less often **or** pressure decreases to atmospheric pressure	B1 B1 B1	[5]
7	(a)		(n =)sin i / sin r **or** sin 55° / sin 33° 1.5(040274)	M1 A1	
	(b)	(i)	angle of incidence greater than critical angle **or** denser to rarer medium	B1	
		(ii)	reflected ray in correct direction (by eye) to edge of block **and** no second TIR (**ign** marked values)	B1	[4]
8	(a)		(P =)VI **or** 230 × 27 6200 / 6210 W **or** 6.21 / 6.2 kW	C1 A1	
	(b)	(i)	1.1 / 1.12 / 1.1178 × 10^7 J	B1	
		(ii)	6.21 × 0.5 × 23 **or** 6.21 × 30 × 23 **or** 3.1 / 3.105 × 23 71 / 71.3 / 71.4 / 71.415 c **or** $ 0.71 / 0.714 / 0.71415	C1 A1	[5]
					[45]

Section B

9 (a) 12 N — B1 [1]

(b) (i) 0 **or** zero — B1
12 N **or** it is equal to the weight — B1
(*F* increases) as the speed increases — B1

(ii) (gravitational) potential to thermal energy **or** to k.e. **of air** — B1

(iii) ($KE = $)$\frac{1}{2}mv^2$ — C1
$\frac{1}{2} \times 1.2 \times 40^2$ — C1
960 J — A1 [7]

(c) (i) ($m = $)$E / l_f$ **or** Q / l_f **or** 960 / 330 — C1
2.9 / 2.91 g **or** 2.9 / 2.91 $\times 10^{-3}$ kg — A1

(ii) any **two** from:
ice is below 0 °C
thermal energy transferred / lost (to ground / air)
work done compressing / compacting the ground — B2 [4]

(d) any **three** from:
molecules fixed in position **or** water molecules move around
molecules vibrate **or** water molecules do not vibrate
molecules in regular lattice **or** water molecules placed randomly
(interatomic) forces between ice molecules larger
ice molecules further apart — B3 [3]

[15]

10 (a) (i) no free electrons (in plastic) **or** all electrons are bound / structural — B1

(ii) (aluminium) is not magnet(ic) **or** cannot be magnetised — B1
(iron) is a temporary / soft magnetic material **or** is not a permanent magnet — B1 [3]

(b) (i) magnetic field / flux (mentioned) — B1
(magnetic) field lines cut wire / solenoid / circuit **or** changing magnetic field / flux — B1
voltage/e.m.f. **induced** — B1

(ii) ($V = $)$IR$ **or** 0.045 × 1.2 **or** 0.000045 × 1.2 — C1
5.4×10^{-5} V **or** 0.054 mV — A1
($Q = $)$It$ **or** 0.045 × 0.14 **or** 0.000045 × 0.14 — C1
6.3×10^{-6} C **or** 0.0063 mC — A1 [7]

(c) (i) larger **or** twice the current — B1
(magnetic) field lines cut faster **or** (magnetic) field changes faster **or** twice the current — B1

(ii) double the current for half the time **or** larger current for less time **or** product $I \times t$ is the same — B1 [3]

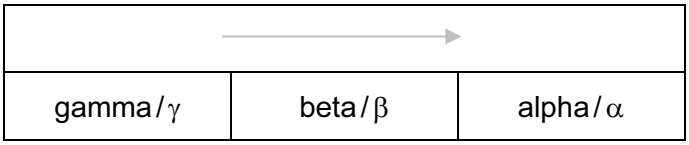
(d) any **two** from:
insert S-pole (at same end)
insert (N-pole) at other end **or** from other direction
withdraw N-pole (from same end implied)
withdraw S-pole from other end **or** pass through completely — B2 [2]

[15]

11 **(a)** 127 n(eutrons) **and** 82 p(rotons) — B1
82 e(lectrons) — B1
electrons in orbit around nucleus / in shells around nucleus **or** around neutrons and protons **or** neutrons and protons in nucleus — B1 [3]

(b) **(i)** more protons **and** fewer neutrons **or** one more proton — C1
one more proton **and** one fewer neutron **or** neutron becomes proton (and electron/beta-particle) — A1

(ii)



reversed order 1 / 2
correct order 2 / 2 — B2

(iii) (circular by eye) curve from beginning of field **not** with straight line initially — B1
upward curve (in field) — B1 [6]

(c) **(i)** (radiation) that is always present **or** occurs everywhere **or** cannot be eliminated **or** from environment / surroundings / natural sources / air — B1

(ii) two separate sources: rocks (e.g. radon / ground), outer space (e.g. cosmic rays), man-made sources (e.g. nuclear waste / fall-out) — B2

(iii) 2 half-lives (implied) **or** ¼ seen **or** 76 (counts / minute) — C1
19 **or** 23 (counts / minute) — C1
35 counts / minute — A1 [6]

[15]