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Cambridge Ordinary Level

MARK SCHEME for the October/November 2015 series

5054 PHYSICS

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

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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]

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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 <u>kinetic</u> 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]

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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

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

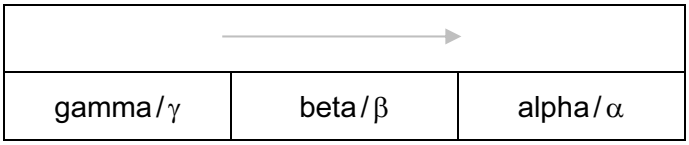
(d) any **two** from:
insert S-pole (at same end)
insert (N-pole) at other end **or** from other direction
withdraw N-pole (from same end implied)
withdraw S-pole from other end **or** pass through completely B2 [2]

[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]

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