

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

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Section A

- 1 (a) $(V =)m/\rho$ or $10\,600/6500/4100/2400 \div 1000$ or 6.5 or 4.1
 $2.4\text{ m}^3/2.4 \times 10^6\text{ cm}^3$ C1
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 $2400 \times 10 \times 850$ C1
 $2.0/2.04 \times 10^7\text{ J}$ 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 $32 \times 1000 \times 10$ C1
 $3.2 \times 10^5\text{ Pa}$ A1
- (b) (i) atmospheric pressure (is also acting on the surface of the water) B1
- (ii) $(F =)pA$ or $4.2 \times 10^5 \times 45$ or $3.2 \times 10^5 \times 45$ or 1.44×10^7 C1
 $1.9/1.89 \times 10^7\text{ N}$ 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 $\sin 55^\circ / \sin 33^\circ$ 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) $6.21 \times 0.5 \times 23$ or $6.21 \times 30 \times 23$ or $3.1 / 3.105 \times 23$ 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) ($m = \frac{E}{l_f}$ 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)

→		
gamma / γ	beta / β	alpha / α

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** $\frac{1}{4}$ seen **or** 76 (counts/minute) C1
 19 **or** 23 (counts/minute) C1
 35 counts/minute A1 [6]

[15]