

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) B1
 divide the difference into 100 units / sections B1 [6]
- 6 (a) they / molecules move / collide faster **or** gain kinetic energy B1
 they / molecules collide **with walls** more often **or** harder B1
- (b) pressure decreases B1
 larger volume (of gas) **or** they / molecules move further between collisions B1
 fewer collisions **per unit time** / reduced collision frequency (of molecules with wall) **or** collide less often **or** pressure decreases to atmospheric pressure B1 [5]
- 7 (a) $(n =) \sin i / \sin r$ **or** $\sin 55^\circ / \sin 33^\circ$ M1
 1.5(040274) 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 C1
 6200 / 6210 W **or** 6.21 / 6.2 kW A1
- (b) (i) $1.1 / 1.12 / 1.1178 \times 10^7$ J B1
- (ii) $6.21 \times 0.5 \times 23$ **or** $6.21 \times 30 \times 23$ **or** $3.1 / 3.105 \times 23$ C1
 71 / 71.3 / 71.4 / 71.415 c **or** \$ 0.71 / 0.714 / 0.71415 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)
- | | | | |
|---|----------------|------------------|----------------------|
|  | | | reversed order 1/2 |
| gamma / γ | beta / β | alpha / α | 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]