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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)** | ($V$ =) $m / \rho$ **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:<br>distort / stretch / change in shape / squeezed / bends / deforms<br>compresses / change in size / volume / density / depth / height<br>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**<br>(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:<br>volume (of gas / liquid) **or** density **or** length (of thread)<br>voltage **or** current **or** e.m.f.<br>resistance<br>pressure (of gas)<br>colour<br>(quantity of) radiation emitted<br>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<br>**or** ice point **and** steam point marked / found (may be implied)<br>divide the difference into 100 units / sections | B1<br>B1 | [6] |
| **6** | **(a)** | | they / molecules move / collide faster **or** gain <u>kinetic</u> energy<br>they / molecules collide **with walls** more often **or** harder | B1<br>B1 | |
| | **(b)** | | pressure decreases<br>larger volume (of gas) **or** they **/** molecules move further between collisions<br>fewer collisions **per unit time /** reduced collision frequency (of molecules with wall) **or** collide less often **or** pressure decreases to atmospheric pressure | B1<br>B1<br>B1 | [5] |
| **7** | **(a)** | | ($n$ = )sin $i$ / sin $r$ **or** sin 55° / sin 33°<br>1.5(040274) | M1<br>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<br>6200 / 6210 W **or** 6.21 / 6.2 kW | C1<br>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<br>71 / 71.3 / 71.4 / 71.415 c **or** $ 0.71 / 0.714 / 0.71415 | C1<br>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]

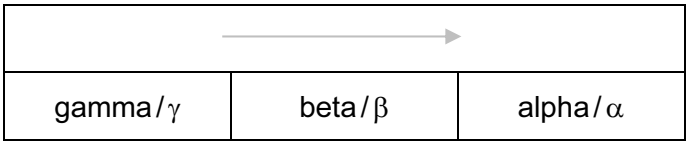
**(d)** any **two** from:
insert S-pole (at same end)
insert (N-pole) at other end **or** from other direction
withdraw N-pole (from same end implied)
withdraw S-pole from other end **or** pass through completely B2 [2]

**[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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