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**Cambridge Ordinary Level**

# MARK SCHEME for the May/June 2015 series

## 5054 PHYSICS

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

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**1** **(a)** weight (pulls spring down and causes tension) B1
**or** force/pull of **gravity**
**or** mass is in gravitational field

**(b)** has a direction B1

**(c)** **(i)** **1** $l = l_0 + e$ **or** $l_0 = l - e$ **or** $e = l - l_0$ B1

**2** 36 cm B1

**(ii)** curve upwards after 10 N B1

**2** **(a)** tape B1

**(b)** **(i)** mass ÷ volume **or** mass per unit volume B1

**(ii)** (V=) 15 × 0.25 × 2 or 7.5 seen C1
2400 kg / $m^3$ A1

**(iii)** (A=) 15 × 0.25 **or** 3.75 **or** (P=) F / A C1
**or** (P=) 18 0000 / A **or** (P=) *dgh* / $\rho gh$ seen
48 000 Pa A1

**(iv)** (length doubles) so both area **and** weight / force double B1
**or** area **and** force / weight both increase / large**r** (in proportion)
**or** height **and** density the same (in $P = dgh$)

**3** **(a)** **(i)** (efficiency =) useful energy ÷ input energy C1
**or** 95 000/120 000 (×100)
0.79(17) **or** 79(.17)**%** A1

**(ii)** ($P$=) energy/time **or** 90 000 / 60 C1
1500 W A1

**(b)** electric kettle **and** B1
- **more** energy / heat **per minute** output / into water / supplied
- more power output

transfers heat / energy faster / at a faster rate

**(c)** steam molecules have more potential energy; further apart; smaller force / bonds between molecules; have latent heat; more random arrangement B1

**4** **(a)** ($H$=) $mcT$ **or** 330 × 4.2 × 13 C1
18 000 J **or** 18 020 **J** **or** 18 018 J A1

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**(b)** ice takes in / needs heat / energy B1
- for latent heat
- to melt / turn to water (at 0 °C) / change state
- to break bonds / for molecules to gain P.E.

water (in jug initially at 0 °C) warms up B1
**or** ice (and melted water in jug)
- stays at 0 °C / stays cold / stays at constant temp.
- gives larger temperature difference (between liquid and melting ice in jug)

**(c)** metal is a good conductor (of heat) B1
**or** metal / can has lower heat capacity
allow opposite statements for plastic, e.g. plastic is an insulator (of heat),
penalise wrong statements and Physics, e.g. liquid evaporates from can, metals conduct temperature / convect better

**5** **(a)** negative charge moves from hair / person / head to balloon C1
electrons move from hair / person / head to the balloon A1

**(b)** hair is positive (at end) B1
opposite charges attract B1
**or** positive and negative attract

**(c)** **charges / electrons** B1
- don't flow away
- aren't conducted (to earth / person)

stay on balloon / on insulator

**(d)** any sensible example e.g. photocopier, electrostatic precipitator, flu ash removal, spray painting, printing, crop spraying, lightning fixes nitrogen in atmosphere etc. B1

**6** **(a)** **(i)** mention of (magnetic) field / flux (of N and S-poles) C1
(coil/wire) cuts **magnetic** field / flux / lines A1
**or magnetic** flux **in coil** changes

**(ii)** (one side of) coil cuts one way and then the other B1
**or** (side) moves one way and then the other / returns
**or** flux increases and then decreases

**(b)** increase in emf for both stronger magnets and more turns B1
no change / same frequency for both stronger magnets and more turns B1
increase and increase for turn the coil faster B1

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**7** **(a)** to provide a complete circuit (with live) B1
**or** to pass current back to mains
**or** provide a return path for the current

**(b)** current / charge / electrons flow to earth / earth wire / ground (when live touches case) B1
fuse melts / blows **and** disconnects circuit / cuts live / stops current B1

**(c)** doubly insulated B1
**or case / body** made of plastic / insulator / not made of metal
**or** user cannot touch metal

**(d)** (circuit breaker) B1
- turns off / acts fast(er)
- can be reset
- easy to see it has tripped / switched
- can detect small difference between live and neutral currents / small (leakage) current to earth

**8** **(a)** left column both 1 B1
right column 0 **and** 1 B1

**(b)** (at least one of the atoms) contain same number of electrons and protons B1
**or have** 1 electron and 1 proton
charge on electron and proton opposite B1
**or** electron negative **and** proton positive
**or** charge on electron neutralises/cancels/balances proton charge
neutrons have no charge B1

**9** **(a)** number of waves (that pass a point) M1
**or** number of oscillations (passing a point)
in unit time **or** per second **or** in 1 second A1

**(b)** **(i)** 1.5 cm B1

**(ii)** ($v$ = )$f\lambda$ **or** $5 \times 1.5$ seen C1
**or** ($s$=)$d / t$ **and** $f = 1 / t$
7.5 cm / s A1

**(c)** **(i)** wavelength decreases B1
travels a shorter distance in the same time B1
**or** frequency stays the same (and $v = f\lambda$)

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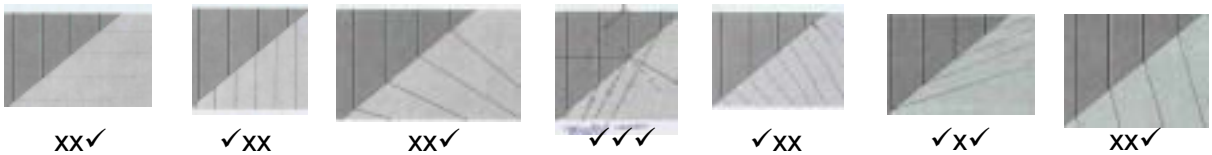
**(ii)** wavefronts with smaller wavelength (by eye) B1
smaller angle to surface (by eye) **and** slanted down B1
wavefronts join those in shallow water B1



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**(d) (i)**

| sound | water |
|---|---|
| particles / wave / source<br>• vibrate / oscillate / move in direction of (travel of) wave / along wave<br>• move backwards and forwards | particles / wave / source<br>• vibrate / oscillate / move at 90º to direction of (travel of) wave<br>• move up and down |
| (contains) compressions and rarefactions<br>**or** particles come closer / further apart | (contains) crests and troughs |
| speed 300–330 m / s | wave slower (than sound) |

B1
B1
one row only

**(ii)** method of generating sound, e.g. (loud) speaker (and signal generator) B1
apparatus that enables refraction clear, e.g. carbon dioxide in balloon or any shape where refraction is possible B1
method of detecting refraction, e.g. microphone and how it is used to show refraction B1

**10 (a) (i) 1** S-pole on right of core B1

**2** N-pole anywhere on vertical section of armature B1
**and** S-pole anywhere on horizontal section of armature
**or**
N-pole on left of vertical section of armature **and** S-pole on right

**(ii)** poles (on core) reverse / change positions B1
(armature still) attracted (to core) B1

**(iii)** (iron is a) temporary magnet B1
**or** (iron) easily demagnetised
**or** steel retains magnetism
when current off / no battery / switch off / circuit open B1
**and**
armature released / does not stay attracted / opens connections (at AB)

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**(b) (i)** thermistor B1

**(ii)** resistance (of X) decreases B1
current (in coil) increases **or** more voltage across coil B1
**and**
**either** relay switch closes **or** circuit (to bell) complete

**(iii)** **1** ($V$=) $IR$ **or** 1.5 ($\times 10^{-3}$) $\times$ 2000 C1
3(.0) V A1

**2** 9(.0) V B1

**3** 12 / 200 **or** 0.06 (A) **or** 60 (mA) seen C1
**or** ($R_T$ =) 195(.12 Ω)
61(.5) mA **or** 0.061(5) A **or** 62 mA **or** 0.062 A A1

**(iv)** light dependent resistor **or** LDR B1

**11 (a) (i)** distance (travelled) per second **or** speed C1
distance (travelled) per second / speed in a given direction A1
**or** displacement / time
**or** change in displacement per unit time
**or** displacement (travelled/covered) per unit time
**or** rate of change of displacement

**(ii)** opposite direction B1

**(iii)** **1** value seen for $v$ and corresponding value of $t$ C1
$0 < t \leqslant 1.4$ and $0 < v \leqslant 14$
($a$=) $v$-$u$ / $t$ algebraic or numerical equation C1
10 m / s$^2$ A1

**2** sensible comment A1

**(iv)** **1** 4(.0 s) B1

**2** weight **or** force due to gravity mentioned (at D) B1
mention of B1
- upwards force (on man) from cord
- tension / elastic force from cord (on man)

force in cord / upward force / tension greater than downwards force B1
**or** resultant force upwards

**(b) (i)** 5000 B1
20 000 B1

**(ii)** ($h$ = ) PE / $mg$ **or** 5000 **=** 50 $\times$ 10 $\times$ $h$ C1
10 m A1

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