

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the October/November 2014 series

5054 PHYSICS

5054/22

Paper 2 (Theory), maximum raw mark 75

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Section A

- 1 (a) limit of proportionality (not breaking point) B1
- (b) (i) 8.5 cm **cao** B1
- (ii) 7.1 – 7.3 cm B1
- (c) $4.0 \times (2.7/7.2)$ **or** $5.0 \times (2.7/9.0)$ **or** 1.5 (N) **or** read from graph **or** 11.2 (cm)
0.148 – 0.152 kg **or** 148 – 152 g C1
A1 [5]
- 2 (a) (i) Fd **or** 2.5×0.18 C1
0.45 Nm A1
- (ii) force not applied at right angles to the tap B1
- (b) long(er) distance needs small(er) force (for same moment) **or** inversely related/proportional B1 [4]
- 3 (a) $V_1 = p_2 V_2 / p_1$ **or** $p \propto 1/V$ B1
 $1.0 \times 10^5 \times (1.8/2.0) \times 10^7$ C1
 $9.0 \times 10^{-3} \text{ m}^3$ **or** 9000 cm³ A1
- (b) (i) $(\rho =) m/V$ **or** $(0.30/9.0) \times 10^{-3}$ C1
 $33(.3333) \text{ kg/m}^3$ **or** $0.033(3333) \text{ g/cm}^3$ A1
- (ii) helium mass/weight small (fraction of total/mass of air included) **or** this includes the weight of the cylinder B1 [6]
- 4 (a) (i) heat gained from burning fuel/combustion **or** friction between moving parts/with air/road **or** from (radiation of) Sun B1
- (ii) heat lost to air/surroundings **or** by convection (currents) **or** exhaust/hot gases/fumes **or** from exhaust **or** heat emitted (by hot car) **or** by radiation B1
- (b) at start chemical energy decreases **or** at start chemical energy to gravitational/potential energy (of car) increases **or** at end of process kinetic energy (of car **or** air) increases B1
B1
B1 [5]

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- 5 (a) downward curve of correct curvature from marked 90 °C B1
horizontal line at marked 58 °C B1
downward (asymptotic) curve of correct curvature to marked 23 °C B1
- (b) H marked halfway (by eye) along an intermediate horizontal line B1
- (c) (Q =) mL **or** 45×220 C1
9900 J A1 **[6]**
- 6 (a) (the molecules) move faster **or** have more **kinetic** energy **or** accelerate B1
ignore vibrate faster
- (b) (i) faster/energetic molecules escape B1
average speed decreases **or** slower molecules remain B1

temperature depends on average KE **or** heat taken from runner B1
OR
liquid becomes gas/vapour
latent heat needed or bonds broken
heat taken from runner
- (ii) water vapour blown away **or** surrounding air less humid B1 **[5]**
- 7 (a) (i) lasts longer **or** one cell can be replaced without switching off the circuit **or** B1
less (internal) resistance **or** if one fails the others still work
- (ii) 1.5 V B1
- (b) (i) (R =) V/I **or** $1.5/0.075$ C1
 $20 (\Omega)$ **or** $1.5/(0.075 - 6.0)$ C1
 14Ω A1
- (ii) decreases B1
resistance of wire increases B1 **[7]**
- 8 (a) one label correct and not contradicted C1
C, 1S and 1B all correct and clear and none contradicted A1
- (b) any **three** from:
magnetic field (between poles)
(coil/wire) cuts field/flux **or** field/flux cuts (coil/wire) **or** field/flux changes
(electromagnetic) induction
brushes rub against/in contact with rings B3
- (c) (half) distance across screen **or** count divisions of/measure wavelength **or** the B1
wavelength corresponds to one rotation B1
half distance multiplied by time base setting **[7]**

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Section B

- 9 (a) changing speed/velocity C1
change in speed/velocity/time constant **or** $(v-u)/t$ constant **or** constant/equal
rate of change of speed/velocity A1 [2]
- (b) (a vector quantity has) direction B1 [1]
- (c) (i) 1. X between $t \geq 0$ and $t < 10$ s B1
2. Y between $t > 20$ s and $t < 30$ s B1
3. Z between $t > 10$ s and $t < 20$ s **or** between $t > 30$ s and $t < 40$ s B1
- (ii) 1. **two** speed values from graph between 15 and 35 s (± 1 mm) C1
two corresponding time values from graph between 15 and 35 s
(± 1 mm) **or** $(a =)\Delta v/t$ C1
500 m/s² A1
2. $(F =) ma$ **or** 8.4×500 C1
4200 N A1
- (iii) 1. arrow labelled F perpendicular to surface of Earth B1
arrow labelled R opposite to direction of travel (by eye) from rock B1
2. speed changes **or** density/pressure of air changes **or** cross-sectional
area (of rock) changes B1
- (iv) it hits the ground/surface of the earth **or** stops **or** speed is zero B1 [12]
- [Total: 15]
- 10 (a) 3.0×10^8 m/s B1 [1]
- (b) (i) 1. decreases **cao** B1
2. no change **cao** B1
3. decreases **cao** B1
- (ii) 1. i correctly marked (to normal) B1
2. r correctly marked (to normal) B1 [5]
- (c) (i) $\sin i/\sin r = n$ **or** $\sin i/\sin r = 1.5$ C1
 $\sin 89/\sin r = 1.5$ **or** $\sin 89/1.5$ **or** 0.67(0.666565) C1
42° **or** 41.8025° A1
- (ii) i equal to/close to 90° $\sin i/\sin 45$ $\sin^{-1}(1/n)/\sin^{-1}(1/1.5)$
and r less than 45° = 1.5 **and** 41.8° B1
or i never bigger than $\sin i > 1$ **or** r not be more than c
89°/90° B1 [5]

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- (d) (i) (sin) $i = 0$ **or** ray enters directly / wavefront / light hits surface
 along normal / perpendicular **or** all together B1
 (sin) $r = 0$ **or** no refraction all slows down together B1
- (ii) correct reflection at bottom surface (by eye) M1
 second correct reflection at top and no refraction at either point A1 [4]

[Total: 15]

- 11 (a) same element **or** same number of protons / atomic number B1
 different / particular number of neutrons **or** nucleons B1 [2]

- (b) (i) 38 **cao** B1
- (ii) 52 **cao** B1 [2]

- (c) ${}_{39}^{90}(\text{Y})$ **or** ${}^{90}(\text{Y})$ and ${}^0(\beta)$ B1
 ${}_{-1}^0(\beta)$ ${}_{39}(\text{Y})$ and ${}_{-1}(\beta)$ B1 [2]

- (d) (i) 87 / 29 **or** 3 (half-lives) **or** $6.0 \times 10^8 / 8$ C1
 7.5×10^7 A1
- (ii) any detector B1
 corresponding detection method B1

detector	film	(solid-state) detector	GM-tube	ionisation chamber	scintillation counter	cloud chamber
detection	fogged	count / reading	count / reading	count / reading	count / reading	track seen

no reduction with paper **or** (use of) electric / magnetic field **or** describe pattern of track M1

complete reduction with aluminium / lead **or** correct deflection of track in electric / magnetic field **or** no other track A1

- (iii) 1. unpredictable **or** not be known in advance **or** no set time between emissions **or** fluctuates **or** not fixed **or** counts obtained varies B1
 2. any **two** from:
 direction / in space
 time
 which nucleus decays B2 [9]

[Total: 15]