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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2014 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

® IGCSE is the registered trademark of Cambridge International Examinations.

CAMBRIDGE
International Examinations

Section A

1 **(a)** limit of proportionality (<u>not</u> 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) C1
0.148 – 0.152 kg **or** 148 – 152 g A1 **[5]**

2 **(a)** **(i)** Fd **or** 2.5×0.18 C1
0.45 N m 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)** $V_1 = p_2V_2/p_1$ **or** $p \propto 1/V$ B1
$1.0 \times 10^5 \times (1.8/2.0) \times 10^7$ C1
9.0×10^{-3} m^3 **or** 9000 cm^3 A1

(b) **(i)** $(\rho =)\ m/V$ **or** $(0.30/9.0) \times 10^{-3}$ C1
33(.3333) kg / m^3 **or** 0.033(3333) 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 B1
gravitational / potential energy (of car) increases **or** at end of process B1
kinetic energy (of car **or** air) increases B1 **[5]**

© Cambridge International Examinations 2014

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
ignore vibrate faster B1

(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**
less (internal) resistance **or** if one fails the others still work B1

(ii) 1.5 V B1

(b) **(i)** (R =) V / I **or** 1.5 / 0.075 C1
20 (Ω) **or** 1.5 / (0.075 – 6.0) C1
14 Ω 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
wavelength corresponds to one rotation B1
half distance multiplied by time base setting B1 **[7]**

© Cambridge International Examinations 2014

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 / s^2 — 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° **and** *r* less than 45° — sin *i* / sin 45 = 1.5 — $\sin^{-1}(1/n) / \sin^{-1}(1/1.5)$ **and** 41.8° — B1
or **or**
i never bigger than 89° / 90° — sin *i* >1 — *r* not be more than *c* — B1 **[5]**

© Cambridge International Examinations 2014

(d) (i) (sin) $i = 0$ **or** ray enters directly / along normal / perpendicular **or** wavefront / light hits surface 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) $^{90}_{39}(\mathrm{Y})$ **or** $^{90}(\mathrm{Y})$ and $^{0}(\beta)$ B1
$^{0}_{-1}(\beta)$ $_{39}(\mathrm{Y})$ 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]

© Cambridge International Examinations 2014