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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CAMBRIDGE

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 × (2.7 / 7.2) **or** 5.0 × (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)** $V_1 = p_2 V_2 / p_1$ **or** $p \propto 1 / V$ B1
   $1.0 \times 10^5 \times (1.8 / 2.0) \times 10^7$ C1
   $9.0 \times 10^{-3}\, m^3$ **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]**

5 (a) downward curve of correct curvature from marked 90 °C   B
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 <u>and</u> not contradicted   C1
C, 1S and 1B all correct and clear <u>and</u> 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]

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)** $3.0 \times 10^8\ m/s$ 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]**

(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 <u>and</u> 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) $^{90}_{39}(Y)$ **or** $^{90}(Y)$ <u>and</u> $^{0}(\beta)$ B1
   $^{0}_{-1}(\beta)$ $_{39}(Y)$ <u>and</u> $_{-1}(\beta)$ 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]