

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 cm^3 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 9900 J	C1 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 average speed decreases or slower molecules remain	B1 B1	
		temperature depends on average KE or heat taken from runner OR liquid becomes gas/vapour latent heat needed or bonds broken heat taken from runner	B1	
	(ii)	water vapour blown away or surrounding air less humid	B1	[5]
	(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 $1.5/0.075$ $20 (\Omega)$ or $1.5/(0.075 - 6.0)$ 14Ω	C1 C1 A1	
	(ii)	decreases resistance of wire increases	B1 B1	[7]
8	(a)	one label correct <u>and</u> not contradicted C, 1S and 1B all correct and clear <u>and</u> none contradicted	C1 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 half distance multiplied by time base setting	B1 B1	[7]

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Section B

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

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- (d) (i) (sin) $i = 0$ **or** ray enters directly/
 along normal/perpendicular **or** wavefront/light hits surface
 (sin) $r = 0$ **or** no refraction all together
 all slows down together
- (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** ${}_{39}^{90}\text{Y}$ and ${}^0_{-1}\beta$ B1
 ${}^0_{-1}\beta$ ${}_{39}^{90}\text{Y}$ and ${}_{-1}^0\beta$ 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]