

CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2013 series

5054 PHYSICS

5054/21

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.

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Section A

- 1 (a) $(m =) \rho V$ or 1000×450
 4.5×10^5 kg C1
A1
- (b) (i) $(Q =) mc\Delta T$ or $4.5 \times 10^5 \times 4.2 \times 15$ or 4200 and $15/(27-12)$ C1
 $4.5 \times 10^5 \times 4200 \times 15$ or $2.8(35) \times 10^7$ C1
 $2.8(35) \times 10^{10}$ J A1
- (ii) thermal/internal energy/heat lost or gained by something specific B1 [6]
(e.g. air/pool walls/tiles etc.) or heat lost by evaporation
- 2 (a) $F_1x_1 = F_2x_2$ or $550 \times (0.86 \text{ or } 86)/(1.1 \text{ or } 110)$ C1
430 N A1
- (b) both moments increase C1
girl's moment increases more or girl's moment > brother's
or anticlockwise moment greater
see-saw tips down on girl's side A1
B1 [5]
- 3 (a) molecules move/collide (ignore vibrate) C1
molecules collide with the walls (to produce force) A1
- (b) (i) $(p_2 =)p_1V_1/V_2$ or $p_1V_1 = p_2V_2$ or $1.0 \times 10^5 \times 120/16$ or $100 \times 120/16$ C1
 7.5×10^5 Pa or 750 kPa A1
- (ii) $(F =)pA$ or $7.50 \times 10^5 \times 1.2 \times 10^{-5}$ or $750 \times 1.2 \times 10^{-5}$ C1
9(.0) N A1
- (iii) (pressure) greater (than calculated) B1
molecules move faster/have more KE/collide more often (accept vibrate faster) B1
molecules collide more often/frequently or harder/with greater force B1 [9]
- 4 (a) (energy transmitted) by electromagnetic/infra-red (wave)/can travel B1
through a vacuum
infra-red or visible $< \lambda <$ microwaves or λ just longer than visible
(i.e. infra-red scores 2/2) B1
- (b) (i) air is a poor conductor B1
- (ii) convection occurs (primarily) upwards/hot air rises (not heat rises) B1 [4]

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| Page 3 | Mark Scheme | Syllabus | Paper |
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- 5 (a) (thin-walled) bulb **and** capillary tube
mercury/liquid in bulb **and** constriction/U-bend B1
B1
- (b) mercury/liquid contracts B1
mercury/liquid/thread breaks (at the constriction)/constriction stops the mercury falling back
B1 [4]
- 6 (a) steel/alnico/SmCo/NdFeB/magnetite B1
- (b) one needle fully correct **or** both angles correct – i.e. A bottom left to top right diagonal
($0 < \text{angle} < 90^\circ$) **and** B horizontal C1
both needles fully correct (fully = angle and orientation) A1
- (c) (place) magnet in solenoid B1
a.c. supply to solenoid/coil (ignore cell/battery symbol) B1
withdraw magnet (slowly) **or** reduce current (slowly) B1 [6]
- 7 (a) (i) ($I =)P/V$ **or** 9.6/240 **or** 9600 C1
9600/240 **or** 0.040 C1
40 A A1
- (ii) any whole number from 41 to 99 (incl.) **with unit** (A)
(e.c.f. from 0.040 A: 1,2,3 A) B1
- (b) $9.6 \times 25 \times 21$ **or** $9.6 \times 25/60$ **or** $9.6 \times 25/60 \times 21$ **or** 5040 c **or** \$50.40 etc. C1
84 c **or** \$0.84 **or** €0.84 **or** £0.84 **or** Rs0.84 etc. (85.7/86c from 0.42h) A1 [6]
- 8 (a) **Penetration** **Magnetic/electric** **Cloud chamber** **Spark counter**
field
- diagram: diagram: diagram: diagram:
sample, sample, detector, sample, cloud sample, spark
detector, small magnet chamber counter, small
gap gap
labelled **or** clear B1
- (insert/remove) (insert/remove) sample in sample near
(a sheet of) magnet cloud to counter
paper/card/Al chamber
foil (in gap) B1
- no change in increased count in no short, no sparks
count correct direction straight, dense tracks B1

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- (b) any **two** of:
 minimise time of exposure
 lead clothing (e.g. lead gloves **not** radioactive suit)
 forceps, tweezers, tongs, manipulator
 behind protective glass/shield
 wear film badge

B2 [5]

[Total: 45]

Section B

- 9 (a) speed does not have direction **and** velocity does
 or speed = distance/time **and** velocity = displacement/time
 or speed is a scalar **and** velocity is a vector
- B1 [1]
- (b) (i) 700 N
- B1
- (ii) 700 N
- B1 [2]
- (c) (i) 54 m/s
- B1
- (ii) (height/distance =) area (under graph) **or** $(x =)vt$ **or** 54×12
 648/650 m
- C1
 A1
- (iii) (GPE =) mgh **or** $70 \times 10 \times 648$
 $4.5/4.54/4.536 \times 10^5$ J
- C1
 A1 [5]
- (d) (becomes) heat/thermal energy/internal energy
 (**not** kinetic energy (of skydiver) unless qualified as KE of air)
- B1 [1]
- (e) (i) (air resistance) increases
 larger area of parachute
- B1
 B1
- (ii) (skydiver) decelerates/slows down (**not** rises up)
 net upward force
- B1
 B1 [4]
- (f) air resistance decreases
 speed decreases
- B1
 B1 [2]
- [Total: 15]
- 10 (a) (i) speed of sound is (much) less than the speed of light (accept quoted values)
- B1
- (ii) **measure** the time delay (between the lightning and thunder)
 divide distance by time/delay
- B1
 B1 [3]

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- (b) (i) 3.0×10^8 m/s B1
- (ii) $(\lambda =) c/f$ or $3.0 \times 10^8 / 7.5 \times 10^{14}$ C1
 4.0×10^{-7} m A1
- (iii) (in any order) blue, green, orange, red, yellow, (indigo), (violet) or VIBGYOR C1
violet, indigo, blue, green, yellow, orange, red A1 [5]
- (c) (i) correct angle clear/labelled r B1
- (ii) mark/determine entrance and exit points (e.g. trace rays back to glass) B1
join/draw line between entrance and exit points B1
- (iii) 1. $n = \sin i / \sin r$ B1
2. 1.5/1.51/1.506176 with no unit
(not just 1.5 without working out) B1
- (iv) correct direction of refraction at **both** faces M1
completely correct (above blue) A1 [7]

[Total: 15]

- 11 (a) (i) $(I =) V/R$ or 6.0/12.0 or 6.0/(4.0+8.0) or (in (ii)) $(V =) IR$ or 0.50×4.0 C1
0.50 A A1
- (ii) 2.0 V (scores C1 in (a)(i) if not already scored) A1 [3]
- (b) (i) increased or becomes 1.25 A B1
- (ii) decreases or becomes 0.8Ω B1 [2]
- (c) moves up or down or 5.0/2.0 C1
moves up or down by 2.5 cm A1 [2]

(d) (i)

| | | |
|--------------|----------|------------|
| | Y-plates | X-plates |
| (glass) tube | anode | ZnS/screen |

- (5 correct 3 marks, 4 correct 2 marks, 3 correct 1 mark
X and Y plates reversed –1; **allow** focussing anode) B3
- (ii) filament heated/thermionic emission B1
(thermionic) electrons attracted by anode or repelled by cathode B1

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- (iii) to prevent/otherwise collisions with air molecules/to allow to reach the screen/to avoid deflection B1
- (iv) 1. electrons are charged B1
2. backwards **or** towards the back **or** opposite to electron motion **or** to the left **or** from the right B1 [8]

[Total: 15]