

**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  $1000 \times 450$   
 $4.5 \times 10^5$  kg C1  
A1
- (b) (i)  $(Q = ) mc\Delta T$  or  $4.5 \times 10^5 \times 4.2 \times 15$  or 4200 and  $15/(27-12)$   
 $4.5 \times 10^5 \times 4200 \times 15$  or  $2.8(35) \times 10^7$  C1  
 $2.8(35) \times 10^{10}$  J C1  
A1
- (ii) thermal/internal energy/heat lost or gained by something specific  
(e.g. air/pool walls/tiles etc.) or heat lost by evaporation B1 [6]
- 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  
 $7.5 \times 10^5$  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  
through a vacuum B1  
infra-red or visible  $< \lambda <$  microwaves or  $\lambda$  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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- 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 < angle < 90°) **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) B1  
(e.c.f. from 0.040 A: 1,2,3 A)
- (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 field** **Cloud chamber** **Spark counter**
- 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**  $54 \times 12$   
 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)  $3.0 \times 10^8$  m/s B1
- (ii)  $(\lambda = ) c/f$  or  $3.0 \times 10^8 / 7.5 \times 10^{14}$  C1  
 $4.0 \times 10^{-7}$  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  $0.50 \times 4.0$  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  $0.8 \Omega$  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]**