

**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  $15/(27-12)$  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  
 $7.5 \times 10^5$  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 B1  
through a vacuum  
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
- (b) mercury/liquid contracts  
mercury/liquid/thread breaks (at the constriction)/constriction stops the mercury falling back
- 6 (a) steel/alnico/SmCo/NdFeB/magnetite
- (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  
both needles fully correct (fully = angle and orientation)
- (c) (place) magnet in solenoid  
a.c. supply to solenoid/coil (ignore cell/battery symbol)  
withdraw magnet (slowly) **or** reduce current (slowly)
- 7 (a) (i)  $(I = )P/V$  **or** 9.6/240 **or** 9600  
9600/240 **or** 0.040  
40 A
- (ii) any whole number from 41 to 99 (incl.) **with unit** (A)  
(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.  
84 c **or** \$0.84 **or** €0.84 **or** £0.84 **or** Rs0.84 etc. (85.7/86c from 0.42h)
- 8 (a) **Penetration**      **Magnetic/electric field**      **Cloud chamber**      **Spark counter**
- diagram:  
sample,  
detector, small  
gap
- diagram:  
sample, detector,  
magnet
- diagram:  
sample, cloud  
chamber
- diagram:  
sample, spark  
counter, small  
gap  
labelled **or** clear
- (insert/remove)  
(a sheet of)  
paper/card/Al  
foil (in gap)
- (insert/remove)  
magnet
- sample in  
cloud  
chamber
- sample near  
to counter
- no change in  
count
- increased count in  
correct direction
- no short,  
straight,  
dense tracks
- no sparks

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

B1 [1]

B1

B1 [2]

B1

C1  
A1C1  
A1 [5]

B1 [1]

B1  
B1B1  
B1 [4]B1  
B1 [2]**[Total: 15]**

B1

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]**