

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Ordinary Level**

## **MARK SCHEME for the October/November 2012 series**

### **5054 PHYSICS**

**5054/22**

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) appropriate apparatus e.g. ruler, weights, fulcrum  
 action e.g. balance weights on each side  
 one of: force/mass  $\times$  distance **or** calculate moment  
 vary **or** repeat
- (b)  $F \times d$  **or**  $8.0 \times 0.15$   
 1.2 Nm (**not** J)
- 2 (a) (i) 4.5 kg
- (ii) axes labelled with quantity **and** unit  
 linear scale  
 straight line from clear (0,0) to correct point
- (b) answer from candidate's line
- 3 (a) (i)  $(PE = )mgh$  **or**  $75 \times 10 \times 20$   
 $1.5 \times 10^4$  J
- (ii)  $\frac{1}{2}mv^2$  **or**  $\frac{1}{2}75v^2$   
 $v^2 = 400$  (if this is seen it scores the first 2 marks)  
 $v = 20$  m/s
- (b) (G)PE at start  
 KE at start  
 to elastic/strain/clear equivalent /EPE at end  
 (**not** stretch energy; any intermediate energy –1)
- 4 (a) (i)  $(F = )PA$  **or**  $4.6 \times 10^5 \times 0.005$   
 2300 N
- (ii)  $(WD = )F \times d$  **or**  $2300 \times 0.074$   
 170(.2) J
- (b) (i)  $(\Delta T = )Q/C$  **or**  $170/0.27$   
 $629.6(2)/630(.370)$  °C (° is **not** correct)
- (ii) thermal energy/heat lost to cylinder/environment/atmosphere (**not**  
 just 'lost') **or** work done against/heat lost due to friction
- 5 (a) space is a vacuum/empty  
 these methods need matter/medium/molecules  
**or** do not occur in vacuum

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(b) any **three** of:

**day:** white is a poor absorber/good reflector

**day:** less heat absorbed/less heating (of house)

**night:** white is a poor emitter/radiator

**night:** less heat emitted/heat loss (from house)

**anywhere:** of IR/radiation/radiant heat B3 [5]

6 (a) (i) electrons **cao** (not positive electrons) B1

(ii) (from) heated (filament) **or** heat **or** boiled off (from filament) **or** knocked out by energetic/fast-moving atoms B1

(iii) to allow electrons to reach the screen **or** no collisions with (air) atoms/molecules/particles B1

(b)  $(1/t = )I/Q$  **or**  $1.6 \times 10^{-19}/5.6 \times 10^{-3}$  **or**  $5.6 \times 10^{-3}/1.6 \times 10^{-19}$  **or**  $2.86/2.9 \times 10^{-17}$  C1  
 $3.5 \times 10^{16}$  A1 [5]

7 (a) solid-state detector/GM tube/ionisation chamber/scintillation counter/spark counter/spintheoscope B1

count **or** count-rate **or** reading referred to B1

(some) detection with appropriate blocking in the way **or** same reading/track in electric/magnetic field B1

**OR**

film B1

develop B1

(some) detection with appropriate blocking in the way **or** same reading/track in electric/magnetic field B1

**OR**

(diffusion) cloud chamber B1

track **seen/looked for/formed** B1

pattern of track described B1

(b) any **two** lines:

one **distance** method: tongs/robotic arm/carry in large box

one **protection** method: lead suit/lead gloves/lead boxes/shield

one **time** method: reduced time/wear badge B2 [5]

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- 8 (a)  $^{15}_8\text{O}$ /oxygen-15/oxygen (nucleus) B1
- (b) (i)  $^{12}_6\text{C}$  and  $^{14}_6\text{C}$ /carbon-12 and carbon-14/the two carbon nuclei B1
- (ii)  $^{14}_6\text{C}$  and  $^{14}_7\text{N}$ /carbon-14 and nitrogen-14 B1
- (iii)  $^{14}_7\text{N}$  and  $^{15}_8\text{O}$ /nitrogen-14 and oxygen-14/the nitrogen and oxygen nuclei B1 [4]
- [Total: 45]

### Section B

- 9 (a) (i)  $(p = )\rho hg$  or  $1000 \times 15 \times 10$  C1  
 $1.5 \times 10^5 \text{ Pa}$  A1
- (ii)  $2.5 \times 10^5 \text{ Pa}$  B1 [3]
- (b) (i)  $p_1V_1 = p_2V_2$  or  $250\,000 \times 0.048 = 100\,000 \times V_2$  C1  
 $0.12 \text{ m}^3$  A1
- (ii) molecules/particles: further apart or their speed is unchanged B1  
(molecular) collisions with balloon/walls/unit area B1  
less frequent collisions (**not** if force/violence of each collision less) B1 [5]
- (c) water molecules: close(r)/move in clusters/move within the liquid B1  
or air molecules: far/further apart/move individually/move throughout container [1]
- (d) (i) net/resultant/unbalanced force upwards (at first) B1  
or upwards force greater
- friction/resistance/drag/downward force increases
- (until) downward force = upward force/forces balance/no resultant force B3
- (ii) starts from **marked** (0,0) or initial gradient = 0 B1  
increasing gradient initially B1  
constant gradient (must be greater than zero) finally B1 [6]
- [Total: 15]

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- 10 (a)**  $(\lambda = )v/f$  or  $2 \times 10^8/4.7 \times 10^{14}$   
 $4.3 \times 10^{-7} \text{ m}$  C1  
A1 [2]
- (b)** raybox/light source/ pin(s) and mirror  
laser and mirror B1  
shine ray at mirror B1  
mark rays or two more pins in line with image B1  
measure  $i$  and  $r$  and equal measure  $i$  and  $r$  and equal B1  
repeat repeat B1 [5]
- (c) (i)**  $83^\circ$  B1
- (ii)** total internal reflection or TIR **cao**  
**angle of incidence** exceeds critical angle B1  
B1 [3]
- (d) (i)** (at least) one ray from X to mirror M1  
(at least) **two** rays from X to mirror and correct reflections A1  
rays traced back to marked I or I marked in correct place (by eye) B1
- (ii)** 0.19m B1
- (iii)** less/no light wasted or hall brighter B1 [5]
- [Total: 15]**
- 11 (a) (i)**  $4.5 + 0.3$  or 4.8 C1  
 $(I = )V/R$  or  $12/4.8$  or  $12/4.5$  or  $12/0.3$  or  $12/0.28125$  C1  
2.5 A A1
- (ii)** decrease resistance (of variable resistor) B1  
increase current (in solenoid) B1
- (iii)** 1. force on PQ/wire or PQ/wire moves M1  
force/movement out of page/outwards/towards observer  
(not upwards) A1  
2. force/speed/acceleration larger B1 [8]
- (b) (i)**  $(P = )VI$  or  $75 \times 12$  C1  
900 W A1
- (ii)** (thick wires) have low resistance B1  
(thick wires) not as hot/do not melt B1
- (c)** current to relay/coil/solenoid/electromagnet B1  
core/relay/coil/solenoid/electromagnet magnetised B1  
connections made (in motor circuit) B1 [7]
- [Total: 15]**