

**MARK SCHEME for the May/June 2012 question paper  
for the guidance of teachers**

**5054 PHYSICS**

**5054/22**

Paper 2 (Theory), maximum raw mark 75

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### Section A

- 1 (a) (i) (amount of) matter/material/substance it contains B1
- (ii) **use of scale** and subtraction/difference/increase in lengths/readings  
OR read distance between two marks **on the scale** with different masses B1
- (b) (i) two force **values** with  $F_A > F_B$  for the same extension  
OR two extension **values** with  $e_B > e_A$  for the same force/at maximum B1
- (ii) idea that A is a straight line and B is not  
OR gradient constant in A but not in B  
OR same increase in F every cm for A but not B B1
- (iii) 15 N B1 [5]
- 2 (a) a force B1  
when objects slide over/rub one another  
OR opposes (relative) **motion/movement** B1
- (b) (i) constant/uniform speed OR constant/uniform velocity OR zero acceleration B1
- (ii) ( $F =$ )  $ma$  seen in any form numerical or algebraic C1  
1200 (N) OR 6200 N seen C1  
3800 N A1
- (iii) Force B increases OR backwards force/resistance/friction/drag increases  
as speed/velocity increases M1  
A1
- (c) ( $PE =$ )  $mgh$  in any form numerical or algebraic C1  
1 600 000 J A1 [10]
- 3 (a) large(r) temperature difference (between bedroom and outside)  
OR outside is hot(ter than main room) B1
- (b) (i) 3 300 000 J(/hour) B1
- (ii) ( $E =$ )  $P \times t$  in any form;  $300 \times 60 \times 60$  C1  
 $1.08 \times 10^6$  J;  $1.1 \times 10^6$  J  
OR 0.3 kWh A1
- (c) cold air sinks B1  
  
(cold air has a) high(er) density or contracts B1  
  
hot air rises  
OR hot air has a low(er) density  
OR (hot) air comes in to replace cold air B1 [7]

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- 4 (a) 80 °C B1
- (b)  $(Q =) mcT$  in any form numerical or algebraic  
1530J C1  
A1
- (c) (i) Any 2 lines from
- **latent** heat/energy mentioned
  - **latent** heat/energy given out/lost
  - bonds being made/strengthened
  - molecules lose PE
  - molecules KE constant
- B2
- (ii) ANY 2 lines but max 1 if no change/comparison implied  
molecules change **from** OR in liquid
- random arrangement
  - move throughout in some form (e.g. move freely)
  - move or occur in clusters
- change **to** OR in solid
- regular arrangement/shape or fixed position/shape
  - vibrate
  - separation (probably) close(r)
- B2 [7]
- 5 (a) more telephone signals (at one time)  
OR great(er) bandwidth; more data (per sec); more signals  
OR faster data/information transfer  
OR less attenuation; less energy/power/signal loss;  
OR long(er) distance (before regeneration)  
OR (more) secure  
OR less noise/interference OR high(er) quality/clear(er) B1
- (b) (i) correct normal and angle marked B1
- (ii) total internal reflection B1  
**angle of incidence** is larger than critical angle B1
- (c)  $(n =) \sin i/\sin r$  in any form numerical or algebraic C1  
35(.2644)° **unit ° needed** A1 [6]
- 6 (a) Any 2 of
- an oscillation/vibration/movement up and down
  - carries energy
  - no (net) movement of the medium/transfer of matter
- B2
- (b) arrow downwards or upwards or both B1

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- (c) (i)  $(v =) f\lambda$  in any form numerical or algebraic  
5(.0)cm/s or 0.05(0)m/s C1  
A1
- (ii) line or indication **labelled D** of length 2 wavelengths B1 [6]
- 7 (a) three lines from one sphere to the other **and** some lines should spread out as they leave one sphere **and** come together nearing the other B1
- correct direction on at least one line and none wrong B1
- (b)  $(I =) Q/t$  in any form numerical or algebraic C1  
 $2.4 \times 10^{-3} \text{ A}$  A1 [4]

|        |                                |          |       |
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### Section B

- 8 (a) (i) **correct circuit symbols** containing, in any circuit, a
- battery/cell/d.c. power supply
  - ammeter
  - voltmeter
  - fixed resistor
- B1
- ammeter clearly measures current through W
- B1
- voltmeter clearly across W if W shown or a resistor if not
- B1
- (ii) Any 2 from
- resistance (calculated from)  $V/I$  or  $V = IR$  seen
  - length (of wire),  $V$  and  $I$  **all three** measured
  - change length **and**  $V$  and  $I$  measured
- B2
- (iii) 1. resistance/resistivity changes (with temperature)  
OR wire gets hot **and** melts/burns/catches fire/dangerous  
OR  $V$  only proportional to  $I$  at constant temperature
- B1
2. use of a water bath/heat sink  
OR use small currents  
OR take reading (quickly) and switch off
- B1
- (b) (i) ( $V = IR$  in any form numerical or algebraic  
 $2(.0)V$ )
- C1  
A1
- (ii)  $0.1(0)A$
- B1
- (iii) (Z) has the same potential difference/voltage
- B1
- (Z) has less/small(er) current (thus larger resistance)
- B1
- (iv) (p.d. across X =)  $0.3 \times 10(V)$   
OR ( $R_Z =$ )  $2/0.1$  OR  $20(\Omega)$  seen
- C1
- (total p.d.)  $5(V)$   
OR  $6.7(\Omega)$  seen  
OR  $1/R_T = 1/R_1 + 1/R_2$  in any form numerical or algebraic OR  $20/3$  seen
- C1
- $16.7 \Omega$  ;  $17 \Omega$  ;  $16.67 \Omega$  ;  $16.66 \Omega$
- A1 [15]
- 9 (a) (i) conventional current direction correct in coil/one lead
- B1
- (ii) at least 1 line axially through coil A  
OR line above and below end of coil A
- B1
- at least two curved lines in ring from ends of A  
to ends of B (and inside A and B)
- B1
- correct direction on at least one line/arrow for candidate's (i)
- B1

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|            |                                                                                                                                                                                                                                                                                                                                                      |          |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| (b) (i)    | (magnetic) flux/field <b>cuts</b> (coil B)<br>OR field/flux changes (in coil B)                                                                                                                                                                                                                                                                      | B1       |
|            | <b>induces</b> an e.m.f./voltage/current (in B)                                                                                                                                                                                                                                                                                                      | B1       |
| (ii)       | (voltmeter) deflects to left/opposite (and returns to zero)                                                                                                                                                                                                                                                                                          | B1       |
|            | flux/field decreases/collapses/reduces<br>OR iron loses magnetism<br>OR <b>change</b> in field is in opposite direction<br>OR to oppose flux/field change                                                                                                                                                                                            | B1       |
| (iii)      | ANY 2 lines<br>more turns on coil <b>B</b><br>larger voltage/current (e.g. of battery)/more cells<br>battery smaller (internal) resistance<br>smaller resistance of wires; thicker wires; shorter wires<br>thicker or shorter iron ring; use <b>soft</b> iron;<br>coil A and B closer (on ring);<br>more sensitive voltmeter; laminate the iron ring | B2       |
| (c) (i)    | $(P =) VI$ algebraic or numerical<br>384 W OR 380 W                                                                                                                                                                                                                                                                                                  | C1<br>A1 |
| (ii)       | $(P =) I^2R$ OR $(P =) V^2/R$<br>OR $VI$ and $V/R$ seen algebraic or numerical<br>OR clear voltage of 4(.0 V) or 8(.0 V) seen                                                                                                                                                                                                                        | C1       |
|            | $1.6^2 \times 2.5$ OR $1.6^2 \times 5$<br>OR (power) 6.4 (W) seen                                                                                                                                                                                                                                                                                    | C1       |
|            | 12.8 W OR 13 W                                                                                                                                                                                                                                                                                                                                       | A1 [15]  |
| 10 (a) (i) | two protons<br>OR has charge +2(e)<br>OR helium nucleus OR He nucleus                                                                                                                                                                                                                                                                                | B1       |
|            | (and) two neutrons<br>OR has mass 4 (u)<br>OR symbol ${}^4_2\text{He}$                                                                                                                                                                                                                                                                               | B1       |
| (ii)       | electromagnetic (particle/wave)<br>high frequency/high energy/low wavelength                                                                                                                                                                                                                                                                         | M1<br>A1 |
| (b) (i) 1. | alpha identified (as the reason)                                                                                                                                                                                                                                                                                                                     | B1       |
|            | (alpha) particles <b>stopped/blocked/absorbed</b> (few cm air)<br>OR distance covered by/range of (alpha) particles (in air) is small/a few cm                                                                                                                                                                                                       | B1       |
| 2.         | experiment takes time in some way<br>OR otherwise count falls (during half life)                                                                                                                                                                                                                                                                     | B1       |

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- (ii) keep distance (e.g. use forceps/tongs, do not point at person/eyes)  
OR use absorber (e.g. lead covering)  
OR place in store when not in use; use for short time  
OR wear badge B1
- (c) (i) YES (alpha particles present)  
**and** count falls **with paper** in some way B1
- (ii) NO (beta particles) M1  
when (5 mm) Al used **and**  
no **further/more/extra** reduction OR no difference A1
- (iii) YES (gammas present) B1  
**and** gammas pass through (5 mm) Al **or** 820 after Al
- (d) ANY 2 lines B2  
cosmic rays; the Sun; outer space  
rocks (e.g. granite); stones; soil; buildings; food  
radon/thoron/carbon-14 (gas)  
weapons tests; nuclear bombs  
**leaks** from (nuclear) power stations  
nuclear waste
- (e) cancer (accept any specific cancer); tumours  
radiation sickness; burns; mutations;  
genetic problems; damage to DNA/chromosomes  
cell damage (e.g. kills cells, cures cancer); birth defects  
sterility; hair loss B1 [15]