

**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
 1.08×10^6 J; 1.1×10^6 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
- 16.7Ω ; 17Ω ; 16.67Ω ; 16.66Ω
- 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 cuts (coil B) OR field/flux changes (in coil B)	B1
	induces 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 OR iron loses magnetism OR change in field is in opposite direction OR to oppose flux/field change	B1
(iii)	ANY 2 lines more turns on coil B larger voltage/current (e.g. of battery)/more cells battery smaller (internal) resistance smaller resistance of wires; thicker wires; shorter wires thicker or shorter iron ring; use soft iron; coil A and B closer (on ring); more sensitive voltmeter; laminate the iron ring	B2
(c) (i)	$(P =) VI$ algebraic or numerical 384 W OR 380 W	C1 A1
(ii)	$(P =) I^2R$ OR $(P =) V^2/R$ OR VI and V/R seen algebraic or numerical OR clear voltage of 4(.0 V) or 8(.0 V) seen	C1
	$1.6^2 \times 2.5$ OR $1.6^2 \times 5$ OR (power) 6.4 (W) seen	C1
	12.8 W OR 13 W	A1 [15]
10 (a) (i)	two protons OR has charge +2(e) OR helium nucleus OR He nucleus	B1
	(and) two neutrons OR has mass 4 (u) OR symbol ${}^4_2\text{He}$	B1
(ii)	electromagnetic (particle/wave) high frequency/high energy/low wavelength	M1 A1
(b) (i)	1. alpha identified (as the reason)	B1
	(alpha) particles stopped/blocked/absorbed (few cm air) OR distance covered by/range of (alpha) particles (in air) is small/a few cm	B1
	2. experiment takes time in some way 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)
and gammas pass through (5 mm) Al **or** 820 after Al B1
- (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]