UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

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   M1
           as speed/velocity increases   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]

4 **(a)** 80 °C   B1

(b) ($Q =$) mcT in any form numerical or algebraic   C1
1530 J   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   C1
        5(.0) cm/s or 0.05(0) m/s   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
       2.4×10^{-3} 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   C1
2(.0) V   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 × 10 (V)
OR (R_Z =) 2/0.1 OR 20 (Ω) seen   C1

(total p.d.) 5 (V)
OR 6.7 (Ω) seen
OR $1/R_T = 1/R_1 + 1/R_2$ in any form numerical or algebraic OR 20/3 seen   C1

16.7 Ω ; 17 Ω ; 16.67 Ω; 16.66 Ω   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

(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
		$1.6^2 × 2.5$ OR $1.6^2 × 5$ 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 $^4_2$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) A*l* used **and**
no **further**/**more**/**extra** reduction OR no difference   A1

(iii) YES (gammas present)
and gammas pass through (5 mm) A*l* **or** 820 after A*l*   B1

(d) ANY 2 lines
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   B2

(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]

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