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
1.08×106 J; 1.1×106 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 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

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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 C1
384 W OR 380 W 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 $^4_2$He B1

(ii) electromagnetic (particle/wave) M1
high frequency/high energy/low wavelength 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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