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

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.

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UNIVERSITY of CAMBRIDGE
International Examinations

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]

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

(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]

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 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

(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]