CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2014 series

5054 PHYSICS

5054/21 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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Section A

1 **(a)** speed and direction **or** (change in) distance per sec / unit time + direction
or (change in) displacement per sec / unit time [B

(b) two vectors at 45° and one twice the other by eye or labelled 2 (m / s) and 4 (m / s) [B1]
correct resultant shown for two labelled vectors at any angle with directions shown [B1]
resultant speed 5.6 ± 0.2 m / s unit needed [B1]
direction (0)15° **or** N15 °E, etc. **or** any clear direction expressed
or angle mentioned on answer line **and** shown on diagram [B1]

[5]

2 **(a)** current **and** voltage / p.d. / e.m.f. in correct order [B1]

(b) (c=) E / mT in symbols or numbers e.g. 17 000 = 0.85 × c × 22 [C1]
910 J / (kg °C) [A1]

(c) **(i)** (hot air) rises **or** convection mentioned [B1]
(hot) air less dense [B1]

(ii) lag **or** cover with insulating material **or** warmer room **or** start with colder block [B1]

[6]

3 **(a)** converging **or** convex [B1]

(b) image height ÷ object height [B1]

(c) **(i)** line when extended back joins top of image with intersection of ray and lens [B1]

(ii) 3.0 ± 0.1 cm ecf from diagram [B1]

(iii) any two further lines from top of stamp that appear to come from the top of the image [B1]

[5]

4 **(a)** arrow from N to S on at least three lines

(b) magnetic field goes through soft iron **or** no field through clips [B
paper clips lose their (induced) magnetism [B1]

(c) otherwise beam / electrons / cathode ray / charged particles deviated **by magnetic field** [B1]

[4]

5 **(a)** **equal numbers** (5 or less) of negative charges on left **and** positive charges on right [B1]

(b) **(i)** C becomes less positive / less charged [B1]
U becomes (completely) positive [B1]
electrons / negative charge flows from U to C **or** + (on C) and – (on U) cancel / neutralise [B1]

(ii) like charges repel **or** both have same charge **or** both positive [B1]

[5]

6 **(a)** arrows on long sides in opposite vertical directions [B1]
downwards on right **and** upwards on left **or** correct rotation shown [B1]

(b) no (horizontal) distance between forces **or** forces through axle / pivot / axis [B1]

(c) two halves of split ring clear and clearly connected to each end of coil [B1]
contacts / brushes labelled or described **and** connected to battery [B1]
each side of split ring touches other terminal / brush **or** current reverses in coil **or** changes terminals of connection to battery [B1]
forces reverse on **sides** of coil **or** forces always in same direction on **side** nearest a pole [B1]

[7]

7 **(a)**

A	B
6.(0) V	0 (V)

[B1,

(b) **(i)** resistance (of thermistor) decreases [B1]
current increases **and** larger voltage across 2000 Ω / fixed resistor
or smaller **fraction** of voltage across thermistor **or** potential divider explained [B1]

(ii) (I =) V / R in symbols or numbers [A1]
0.002(0) A; 2 mA [C1]

[6]

8 **(a)** **(i)** 53 protons **not** if also 53 electrons in nucleus [B1]
78 neutrons **or** 131 protons and neutrons [B1]

(ii) emission of at least one of alpha particle, beta particle or gamma ray [B1]
emission from the nucleus **or** breakdown of nucleus [B1]

(b) **(i)** random emission indicated [B1]

(ii) average 2772 **or** 2773 **or** 2770 **or** 2800 **or** 1 / 8 used **or** 3 clear halvings seen
or $(½)^3$ seen **not** halving of 131 or 53 [C1]
value between 330 and 360 [A1]

[7]

SECTION B

9 (a) (i) force per unit area **or** force divided by area **or** force on 1 m^2 **or** force on unit area [B

(ii) more water above **or** more force from water **or** more atoms / molecules above [C1]

larger weight of water above [A1]

(iii) Pa **or** N / m^2 [B1]

(b) electrical energy at start of process [B1]
kinetic energy of water / turbine/blade produced [B1]
some heat energy / thermal energy / internal energy produce [B1]

(c) (i) (M=) D × V in any algebraic or numerical form [C1]
780 kg [A1]

(ii) (W=) mgh or Fd in any algebraic or numerical form [C1]
11700 J **or** 12000 J [A1]

(iii) (P=) W / t in any algebraic or numerical form **or** 195(W) [C1]
3.25 **or** 3.2 **or** 3.3 W [A1]

(d) find difference in mass of container, with and without water [B1]
measuring cylinder or similar instrument used to find volume **and** density checked [B1]

other methods are possible, e.g. use of calibrated hydrometer

[15]

10 (a) (shortest) distance between two points in phase [B1]

(b) (i) oscillate **or** vibrate **or** move closer and further [B1]
backwards and forwards **or** in direction of wave (energy) **or** longitudinal mentioned [B1]

(ii) move in opposite directions **or** when A is on right B is on left (of mean)
or A molecules next move apart **and** B next move together [B1]

(c) diagram containing sound source (bell / tuning fork, etc.) in container [B1]
vacuum / pump connected to container [B1]
remove air [M1]
sound decreases [A1]

(d) (i) sound (that returns) after a reflection

(ii) (s=) d / t in any algebraic or numerical form e.g. 20 (or 40) / 0.12 (or 0.06)
330 **or** 333 m / s [A

(iii) (f=) v / λ in any algebraic or numerical form e.g. 330 / 30 (or 0.03) [C1]
correct conversion of 30 mm to 0.03 m [C1]
11 100 Hz **or** 11 000 Hz [A1]

(iv) 0.015 m **or** 15 mm [B1]

[15]

11 (a) (i) work done **or** energy produced / needed [M1]
per unit charge **or** per coulomb (passing through lamp) [A1]

(ii) **1**. not straight **or** curves **or** gradient changes **or** data used correctly [B1]
2. gets hotter **or** temperature changes **or** resistance increases [B1]

(iii) **1**. 350 mA **or** 0.35 A [B1]
2. Q = It in any form algebraic or numerical **or** 2 × 60 × 60 **or** 7200 (s) seen [C1]
2520 C **or** 2500 C [A1]
3. (E=) QV or V*I*t in any algebraic or numerical form, e.g. 0.35 × 6 × 2 [C1]
15100 J **or** 15120 J **or** 15000 J **or** 4.2 kWh [A1]
4. current and / or voltage falls / varies
or some energy remains (in cell)
or some energy / heat produced **in cell**
or correct argument involving internal resistance of cell [B1]

(b) lasts longer [M1]
(because) larger energy (initially) **or** smaller current (in each cell) [A1]
or
avoids failure if one cell fails (M1)
(because) other (parallel) cell takes over (A1)
or
larger current / power (in external resistor / lamp) (M1)
(because) smaller (internal) resistance of combined cells (A1)

(c) symbol for LED clear and in correct direction for cells shown [B1]
4 cells (not all in parallel or in series), switch and LED (labelled or shown) that switches on and off properly [B1]
cells connected correctly to give 3.0 V total e.m.f., e.g. two sets of parallel cells connected in series or three in parallel and one in series [B1]

[15]