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

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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 [B1]

(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. $17\,000 = 0.85 \times c \times 22$ [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]

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4 **(a)** arrow from N to S on at least three lines [B1]

(b) magnetic field goes through soft iron **or** no field through clips [B1]
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]

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7 (a)

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

[B1, 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]

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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 [B1]

(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]

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(d) (i) sound (that returns) after a reflection [B1]

(ii) (s=) d / t in any algebraic or numerical form e.g. 20 (or 40) / 0.12 (or 0.06) [C1]
330 **or** 333 m / s [A1]

(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]

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