CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2013 series

5054 PHYSICS

5054/21 Paper 2 (Theory), maximum raw mark 75

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Section A

1 **(a)** 11 cm B1

(b) (graph is) a straight line/linear **or** has constant gradient **or** not curved B1

(c) **(i)** change in speed/velocity M1
same change in uniform/same time **or** in 1 s A1

(ii) **1.** 0.8 N B1

2. (*a*=) *F*/*m* algebraic or numerical e.g. *F* = *ma*; 0.8/0.2 C1
(ecf **1.** but **not** if *F* = 0)
4(.0) m/s^2 A1 [7]

2 **(a)** total/resultant **moment** zero **or** (sum of) clockwise = anticlockwise **moment** B1

(b) F_1d_1 **or** F_2d_2 seen in any form C1
8(.0) N A1

(c) 4 + 1.2 or 5.2 seen C1
2.8 N ecf **(b)** i.e. accept 5.2 – **(b)** or **(b)** – 5.2 A1 [5]

3 **(a)** Q and R B1

(b) ρgh in any form, algebraic or numerical C1
1.0(336) $\times$ 10^5 N/m^2 A1

(c) water is less dense **or** has density 1000 (kg/m^3) B1
water further up tube/fills tube **or** height greater **or** water enters pump **or** water boils B1 [5]

4 **(a)** **(i)** 120 °C **or** –10 to 110 °C B1

(ii) same distance/length (on scale) for a temperature rise (along scale) **or** regular intervals/equal divisions (**ign.** numbers equally spaced) B1

(iii) diagram with any two markings further apart and none less B1

(b) resistance (of metal); e.m.f./voltage/current/p.d. (of thermocouple); pressure of gas;
colour; quantity of radiation (**ign.** radiation) etc. B1 [4]

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5 **(a)** critical angle B1

(b) **(i)** light refracted out into air **and** bent away from normal (ignore reflected ray) B1

(ii) correct internal reflection (by eye) **and** no refracted ray (**not** at 90°) B1

(c) (t =) distance/speed in any form numerical or algebraic (e.g. d/s, s/v $10/2 \times 10^8$) C1
2.5×10^{-10} s A1 [5]

6 **(a)** current is directly proportional to voltage (**accept** voltage/current = constant, but **not** just = R) B1
if temperature/physical conditions constant B1

(b) (R=) V/I in any form algebraic or using any value of V and I from graph C1
20 Ω A1

(c) **(i)** 40 Ω **or** 2 × **(b)** B1

(ii) straight line graph through origin below given line ecf **(b)** (e.g. **accept** above line if R < 20) M1
goes through 0.1 A at 4 V ecf **(b)** (e.g. allow through 0.2 A at 2 V if R = 10 Ω) A1 [7]

7 **(a)** correct symbol for thermistor B1
in series circuit with any power supply (e.g. cell or two circles) and a fixed resistor B1

(b) **(i)** 12 (V) B1
0.018 (A) B1

(ii) (P=) VI in any form algebraic or numerical with any voltage (4, 8 or 12) C1
0.14(4) W A1

(iii) above maximum power **or** gets too hot **or** blows up **or** fails B1 [7]

8 **(a)** (soft) iron/mu-metal B1

(b) magnetic field **or** flux **or** flux/magnetic lines mentioned B1
changing magnetic field **or** changing flux **or** flux lines cut coil B1
induced voltage/current/e.m.f. B1

(c) less power/energy/heat loss (**allow** no power loss/to prevent power loss) **or** more efficient **or** thinner wire can be used (**ign.** cheaper) B1 [5]

[Total: 45]

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Section B

9 (a) (i) mass is the amount of matter/substance **or** to resist (change in) motion **or** (measurement of)inertia — B1
weight is the pull/force of gravity **or** pull of Earth — B1
accept *mg* where *g* stated as 10 (N/kg) or grav. field strength or acc. due to gravity
ignore *mg* where *g* is gravity or grav. force or undefined

(ii) *mgh* algebraic or numerical — C1
1200 J — A1

(iii) ½ mv^2 algebraic or numerical — C1
(speed =) 9/12 **or** 0.75 seen — A1
5.6(25) J — A1

(iv) (*E*=) *VIt* algebraic or numerical — C1
4100 J **or** 4140 J — A1

(v) 1. energy can neither be created or destroyed/lost — B1
(but) may change form / be transferred — B1

2. electrical energy changes to P.E. (and K.E. and heat/work against friction; **ign**. mechanical energy) — B1 [12]

(b) (i) will not run out **or** infinite **or** being replaced (**allow** does not finish/always available)
(**ign.** cannot be reused/recycled) — B1

(ii) wind, tidal, solar/Sun, geothermal, hydroelectric, biomass, waves, wood (**not** nuclear) — B2 [3]
(**allow** biogas/biofuel e.g. cane into petrol, dung into gas etc.) (**ign.** tidal waves)

[Total: 15]

10 (a) (i) (amount of) energy/work — M1
(by a device of power) 1 kW in 1 hr — A1

(ii) 80/1000 **or** 0.08 seen (e.g. 0.08 × 24 × 25) — C1
168 **or** 24 × 7 (hours) seen (e.g. 0.08 × 24 × 7 × 25) — C1
336 c **or** 340 c (accept $3.36 or any other e.g. £, R) — A1 [5]

(b) (i) *mcT* algebraic or numerical — C1
conversion of mass to g seen, e.g. 1500 used **or** shc used as 4200 — C1
1.6×10^5 J **or** 1.58×10^5 J **or** 157 500 J (**allow** 157(.5) J to score 2/3) — A1

(ii) (*m*=) *E*/*L* in any form numerical or algebraic e.g. 157 500/3.3×10^5 — C1
0.48 **or** 0.477 kg e.c.f. **(i)** — A1

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(iii) **1.** no fixed position/clusters/arranged randomly/close together/closely packed B1
move throughout/at random/slide past each other/not in an organised way B1

2. regular/orderly arrangement/crystal lattice **or** fixed position **or** close together
(**ign.** evenly spaced) B1
vibrate B1

(iv) nothing/no change **and** increases B1 [10]

[Total: 15]

11 **(a)** **(i)** 6 protons B1
8 neutrons B1
6 electrons outside nucleus **or** 6 electrons and protons & neutrons inside nucleus B1

(ii) different number of neutrons B1
same number of protons (ignore electrons) B1 [5]

(b) **(i)** 2 half lives seen e.g. $8 \rightarrow 4 \rightarrow 2$ C1
number of carbon atoms 2×10^{20} A1
number of nitrogen atoms 6×10^{20} **or** $(8 \times 10^{20} - N_C)$ atoms B1

(ii) many half lives **or** has decayed (too much) **or** very few atoms (of C) left B1 [4]

(c) **(i)** background count/rate taken without source B1
any count taken over any measured time e.g. 1 minute
or any rate determined (**allow** read ratemeter) B1
take count/rate with aluminium **between source and detector** B1
at 5 mm count/rate goes to background/constant/zero **when** corrected for background B1

(ii) for protection (of the class/teacher e.g. to avoid cancer) **or** gamma-rays cannot pass through **or** to stop particles (hitting class/teacher) (**ign.** just "for safety") B1

(iii) gamma-rays not stopped by/pass through (5–10 mm) aluminium B1 [6]

[Total: 15]

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