UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

5054 PHYSICS

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

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Do not accept fractions. No penalty for 2 sig. fig. or for 1 sig. fig. where exactly correct.
Only one unit **and only one** fraction **penalty per question**.

Section A

1	**(a)**	**(i)**	11.5 m / s	B1	
		(ii)	decrease in speed // negative gradient	C1	
			equal changes/decreases in speed in the same time // const. neg. grad. on v-t graph	A1	
	(b)	**(i)**	flat line at 18 m / s from t = 0 to 15	B1	
			constant slope downwards parallel to initial line (by eye)	B1	
		(ii)	greater area **under** graph // higher **initial/average** speed	B1	[6]
2	**(a)**	**(i)**	X weight // (force of) gravity // gravitational (force) **and** Y **air** resistance // (air) drag // wind resistance // **air** friction	B1	
		(ii)	(Y) opposes motion // diver moves down // air molecules hit faster from below	B1	
	(b)	**(i)**	accelerates // falls faster // speed/velocity greater	B1	
			X is larger than Y // resultant/net force downwards	B1	
		(ii)	**two** of: X stays the same // Y increases // forces become equal (and opposite)	B2	[6]
3	**(a)**	**(i)**	7000 (J) seen **or** 50% **used** somewhere	C1	
			(P =) E/t // 14000/t // 7000/t seen // 7000 J/minute // 420 000 J/hour	C1	
			120 W	A1	
		(ii)	water after hitting turbine still moves // has KE/energy/velocity // energy lost due to friction // friction **and** location // heat/internal energy **and** location // water misses turbine	B1	
	(b)	**(i)**	can be replaced/made // will not run out	B1	
		(ii)	coal, oil, gas, peat, nuclear, uranium (**not** solar)	B1	[6]

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4 **(a)** (E/Q =) $mc\Delta T$ in any algebraic or numerical form e.g. 4200 × 16, 2100 × 5 C1
67 200 **or** 10 500 **or** 77 700 seen **or** (E/Q =) ml or mL algebraic seen C1
4.2×10^5 J A1

(b) **(i)** break bonds // separate molecules // give molecules more P.E. B1

(ii) (different) change in distance // molecules not so far apart // incomplete bond breaking // doesn't push atmosphere back // less work against atmosphere B1 [5]

5 **(a)** gives out (visible) light // glows B1
when hit by uv/electrons **or** spark/discharge/current in **tube** B1

(b) X-rays or gamma B1

(c) (f =) v/λ numerical or any algebraic form, e.g. $v = f\lambda$ C1
8.3×10^{14} Hz A1 [5]

6 **(a)** reflection (of sound/ultrasound) B1

(b) waves of same period (by eye) B1
smaller amplitude (by eye) B1

(c) **(i)** 20–20 000 Hz B1

(ii) higher than **(i)** B1 [5]

7 **(a)** upward arrow (**not** curved) on iron bar B1

(b) attraction/force not enough//weight of bar too high//friction at pivot/with copper bar B1

(c) **three** of:
electromagnet works // magnetic field created
iron bar moves/lifted up
spring pulls copper bar across/contracts
contacts break circuit // contacts open B3

(d) more turns in coil // more iron in electromagnet // electromagnet nearer iron bar //
iron bar less weight // weaker spring M1
correct explanation which involves force on iron bar A1 [7]

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8 **(a)** all three correct: force, field, current B1

(b) **(i)** *Fd* // 20 × 4; 20 × 2; 20 × 0.04; 20 × 0.02; 20 × 4 × 2; 160 C1
80 N cm, 0.8 N m A1

(ii) more turns (on coil)
use soft iron
more current
increase AB or CD
increase BC or AD ANY 2 B1 [5]

Section B

9 **(a)** **(i)** d.c. current flows in one direction **or**
a.c. current flows in one direction then the other B1

(ii) mention of magnetic field/flux B1
(magnetic) field lines // flux cuts coil // flux changes in coil B1
induction of voltage/current B1
something **relevant** reverses (e.g. field/flux cuts in one direction then the other // N pole approaches then leaves // N pole approaches and S pole approaches)
and link to a.c. B1

(iii) **two** of: thicker wires; more turns of coil; stronger magnet; faster rotation; lower resistance (of lamp) B2

(b) **(i)** to reduce heat/energy/power loss (on the power lines) B1
(higher voltage means) lower current B1

(ii) 25:400 // 1:16 // 0.0625 B1

(iii) reduces resistance // less power loss // costs less to run // more current // more power B1
increases weight // more support needed // more wind resistance // more ice forms // costs more to install B1

(iv) 13 A B1
(*I* =) *P*/*V* // 4.2 A // 4.17 etc A B1
must choose higher value to avoid fuse blowing // other fuses melt B1 [15]

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10	**(a)**	**(i)**	brown and green	B1	
			red	B1	
		(ii)	99×10^9 or 9.9×10^{10} Ω	B1	
		(iii)	*less*: (likely to) burn out/blow // become too hot	B1	
			greater: (likely to) be large (in size)	B1	
	(b)	**(i)**	both involve energy and charge // measured in J/C/volts/by voltmeter	B1	
			energy change is from other forms (accept chemical) to electrical in e.m.f.	B1	
			energy change is from electrical to other forms (accept heat/light) in p.d. (**or** e.m.f. is property of source and p.d. is property of (part of) circuit B2)	B1	
		(ii)	correct symbol	B1	
			correct direction	B1	
		(iii)	p.d. reduces/(approximately) constant **and** current reduces	B1	
		(iv)	$R = V/I$ in any form, e.g. 1.7/0.025, 1.7/25	C1	
			correct conversion to mA, e.g. 0.025/7.3 seen	C1	
			68 or 360 seen	C1	
			290 Ω, 292 Ω	A1	[15]
11	**(a)**	**(i)**	24	B1	
		(ii)	charges (of electrons and protons) cancel // protons and electrons have the same (size of) charge but opposite in sign	B1	
	(b)	**(i)**	nuclear at start // nucleus loses energy	B1	
			to kinetic/e.m. energy (condone light/photon/γ)	B1	
		(ii)	beta 0 at top	B1	
			beta –1 at bottom	B1	
			Mg 24 at top	B1	
			Mg 12 at bottom	B1	
	(c)	**(i)**	600 at 15 hours	B1	
			300 at 30 hours	B1	
			line of decreasing gradient (**not** if it cuts time axis before $t = 30$)	B1	
		(ii)	emission is random // not predictable // not regular // exptl. error	B1	
		(iii)	4800 (counts per minute) // 80 counts /sec	B1	
		(iv)	GM tube/solid state detector/cloud chamber	M1	
			ratemeter/data logger // counter/scalar **and** stopwatch/timer	A1	[15]

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