UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2011 question paper

for the guidance of teachers

5054 PHYSICS

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

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Section A

1 (a) (i) (V =) 64 **or** 6.4×10^{-5} **or** 4^3 **or** 0.04^3 C1
(m =) ρV **or** $920 \times 6.4 \times 10^{-5}$ **or** 920×0.04^3 C1
0.059 kg **or** 59 g **or** 0.05888 kg A1

(ii) 0.59 N **or** 0.5888 N B1

(b) (Q =) ml **or** $0.059 \times 3.4 \times 10^5$ C1
$2.0(0) \times 10^4$ / $2.0(1) \times 10^4$ / 2.006×10^4 J A1 [6]

2 (a) work is done by the (falling) block **or** block loses (G)PE **or** energy transferred from block to elevator **or** forces balance B1
(WD by falling block) raises the elevator **or** converted to GPE **of elevator or** (WD against) friction/air resistance **or** WD to accelerate elevator B1

(b) (WD =) $F \times d$ **or** 4900 × 24 **or** 117 600 **or** (P =) E/t C1
4900 × 24/28 **or** 117 600/28 C1
4.2×10^3 W **or** 4.2 kW A1 [5]

3 (a) (i) one junction in flame **and** three wires and fixed point/ice bath **or** two wires B1
two different metals **and** voltmeter connected B1

(ii) voltmeter reading/voltage at fixed points (e.g. V_0 and V_{100}) B1
compare V_{flame} with $V_{\text{fixed points}}$ (to obtain T) graph/equation/words B1

(b) any **one** of:

rapidly varying temperature	small (heat capacity)
remote measurement	user not near thermometer
direct input to computer B1	electrical output B1

B2 [6]

4 (a) one outer ray parallel to principal axis C1
three rays parallel to the principal axis A1

(b) (i) (speed) reduced **or** slows down B1

(ii) (speed) returns to original value/3.0×10^8 m/s B1

(c) (i) (f =) c/λ **or** $3.0 \times 10^8 / 6.0 \times 10^{-7}$ C1
$5(.0) \times 10^{14}$ Hz A1

(ii) no effect/unchanged/(f =) $5(.0) \times 10^{14}$ Hz B1 [7]

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5 **(a)** **(i)** **electrons** move to the rod B1

(ii) becomes positively-charged/loses electrons B1

(b) **(i)** positives on right **and** negatives on left M1
equal numbers(at least 2) **and** roughly symmetrical A1

(ii) positive charges attracted B1
attraction larger than repulsion **or** positives closer (than negatives to rod) B1 [6]

6 **(a)** **(i)** recognisable sine/cosine curve (≥ 2.0 cycles) B1

(ii) larger (peak)(voltage) B1
higher frequency/shorter period/described in words (**allow** shorter wavelength) B1

(b) (R =) V/I **or** 12/0.50 C1
24 Ω A1 [5]

7 **(a)** volume decreases/quieter/less sound B1
(in some way) resistance between S and C decreases **or** (in some way) voltage (to loudspeaker) reduced B1

(b) (the amplitude) increases B1
(the frequency) remains constant B1 [4]

8 **(a)** $^{131}_{54}\text{Xe}$ **OR** ^{131}Xe **and** $^{0}\beta$ B1
$^{0}_{-1}\beta$ $_{54}\text{Xe}$ **and** $_{-1}\beta$ B1

(b) **(i)** downward curve B1

(ii) horizontal line B1

(c) any **two** of:
direction/space (of emission)
time/frequency (of emission) **or** period/interval between emissions **or** different counts (in same time)
nucleus that decays is unpredictable B2 [6]

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Section B

9 (a) **at start:** chemical (potential) energy B1
at end: PE/GPE/gravitational energy B1
at end: heat/thermal/internal energy B1
at end: KE **or** intermediate KE from chemical energy B1

(b) (i) 0 B1

(ii) it increases B1
to constant value B1

(iii) gradient **or** $(v–u)/t$ **or** (1400-600)/40 **or** other correct numbers C1
$20\,m/s^2$ A1

(iv) (F =) ma **or** $1.6 \times 10^6 \times 20$ C1
3.2×10^7 N A1

(v) 4.8×10^7 N B1

(c) (i) to every action there is an equal and opposite reaction
or forces act in pairs of equal size **and** in opposite directions/on different bodies B1

(ii) downward force on gas B1
equal and opposite to upward/**(b)(v)** force (on rocket) B1 [15]

10 (a) (i)

closed	open			B1
closed	closed			B1

(ii) S_1 closed → motor on B1
S_1 open → heater off B1

(iii) the heater would overheat/burn/melt **or**
more efficient cooking/circulation described B1

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(b) (i) (I =) P/V **or** 3700/230 **or** 3500/230 **or** 200/230 **or** 15(.217) C1
16(.08695) A **or** 16.1 A A1

(ii) integral value: 17 → 40 A **or** up to candidate's **(b)(i)** + 24 B1
live B1

(iii) if case becomes live **or** if live wire touches case B1
fuse blows B1
live/supply disconnected/case safe to touch/prevents shock/
prevented electrocution B1

(c) 0.20/3.5/3.7 (kW) **or** 200/3500/3700 × 12 × 35 C1
0.20/3.5/3.7 × 12 × 35 **or** 1470 c **or** 1554 c **or** 84000 c C1
84 c **or** $0.84 (allow €/£/R etc.) A1 [15]

11 (a) (i) force × distance C1
force × perpendicular distance (from the axis) A1

(ii) 8200 × 0.05 C1
410 N m A1

(iii) (perpendicular) distance reduced/force not perpendicular/only a component
of the force is perpendicular B1

(b) (i) (P =) F/A **or** 8200/0.0067 C1
1.2(23881) × 10^6 C1
1.3(23881) × 10^6 Pa A1

(ii) friction M1
exerts opposing force **or** between piston **and** cylinder A1

(c) pressure decreases **or** F decreases (no contradiction) B1

(d) any **four** lines:
molecules collide with/hit walls
molecules move faster/kinetic energy increases
molecules collide harder (with walls)
molecules collide more frequently (with walls)
greater force/impulse/momentum change (on walls) B4 [15]

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