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

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.

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UNIVERSITY of CAMBRIDGE
International Examinations

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]

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]

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

(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]