UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

5054 PHYSICS

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

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UNIVERSITY of CAMBRIDGE
International Examinations

Section A

1 **(a)** forces balance/cancel **or** no net force **or** upward force = downward force
or weight = air resistance/drag/air friction B1 [1]

(b) **(i)** 9.8–10 m/s^2 B1 [1]

(ii) $a = v(-u)/t$ algebraic or numerical C1
2(.0) m/s ecf **(i)** A1 [2]

(iii) straight line from (0,0) to (0.2,2) ecf **(ii)** B1
after 0.2 s, decreasing but not negative gradient B1 [2]

2 **(a)** **where** extension/stretching stops being proportional to force/load/weight/mass
or extension/load = constant
or point where length or extension against load graph curves C1 [1]

(b) 4 = k 6 **or** 4/6 **or** 6/4 **or** 6 × 2/4 **or** 3 (cm) seen C1
11 cm A1 [2]

(c) different weights/masses/load **and** measure new length B1
how extension is found e.g. reading on scale for loaded spring subtracted from reading with no load/mass/original B1 [2]

3 **(a)** chemical energy to **or** K.E to B1
heat/thermal energy/internal energy – at end B1 [2]

(b) friction/resistive force **increases** B1 [1]

(c) **(i)** work = force × distance in words, number or symbols C1
1.2 × 0.08 **or** 0.096 **or** 20 **or** 0.208 seen C1
20.8 **or** 21 A1 [3]

(ii) power = work/time **or** energy/time, numerical or algebraic – may use values in **(i)**
accept 2/0.2 or 10 **W** C1
0.48 W (ecf **(i)** including power of ten error in **(i)**) A1 [2]

4 **(a)** at least 3 reflected wavefronts with same wavelength as before B1
all **and** ⩾ 2 reflected wavefronts at correct angle B1 [2]

(b) **(i)** no change in direction **and** clearly smaller, approximately constant wavelength B1 [1]

(ii) **1** reduces B1
2 constant B1 [2]

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5 **(a)** **(i)** correct direction of refraction at **both** faces (**not** along normal) B1
blue below red **and** blue and red diverge B1 [2]

(ii) any **two** from orange, yellow, green B1 [1]

(b) **(i)** **total internal reflection or** angle of incidence greater than critical angle B1 [1]

(ii) all colours reflected at same angle **or** all have i = r B1 [1]

6 **(a)** variable resistor **or** rheostat B1 [1]

(b) curved line starting at origin **allow** straight at first **not** two straight lines C1
correct curvature **from origin** with decreasing gradient A1 [2]

(c) **(i)** (resistance) increases (as p.d. increases) B1 [1]

(ii) explanation, e.g. lower current than expected for given p.d. **or** given current needs larger p.d. **or** correct explanation involving $R = V/I$ **accept** gradient decreases B1 [1]

7 **(a)** **(i)** $I = V/R$ **or** 2400 seen C1
0.0025 A (2.5 mA) A1 [2]

(ii) 4 V **or** 1600 × **(i)** ecf B1 [1]

(b) **EITHER**
capacitor stores charge/charges up/stores energy B1
takes time/delay e.g. voltmeter reading rises slowly/capacitor charges up slowly or to a maximum B1
OR
(small) current into transistor/base **or** large base/emitter voltage (>0.6 V) B1
switches (transistor) on **or** large current collector/emitter or resistance of transistor reduced B1 [2]

8 **(a)** meter deflects (one way) B1
changing magnetic field/flux in ring/coil or cutting of flux/field B1
induces voltage/current B1 [3]

(b) ammeter returns to/remains at zero B1 [1]

(c) ammeter deflects in opposite direction (then returns to zero) B1
field decreases/change in opposite direction **or** field/flux cuts in opposite direction B1 [2]

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Section B

9 (a) (i) 120°C **or** –10°C to 110°C B1 [1]

(ii) longer thermometer **or** wider bore **or** less mercury **or** smaller bulb **not** change liquid B1 [1]

(b) (i) measures small(er) change in temperature **or** small(er) range for same distance **or** large(r) expansion for (same) temperature rise B1 [1]

(ii) larger bulb **or** more liquid **or** narrower bore/tube **or** use liquid that expands more B1 [1]

(c) constriction/narrowing (**accept** 1st and 3rd marks on diagram)
mercury/thread breaks at constriction (on cooling) **or** thermometer is a "maximum" thermometer
range different
more sensitive/divisions further apart
triangular cross-section/acts as lens
thin(ner) bulb (quick response to temperature change) ANY 3 lines B3 [3]

(d) (i) two different metals joined M1
connected to meter/ammeter/galvanometer/voltmeter A1 [2]

(ii) low/high temperatures **or** greater range
responds quickly/measures rapidly changing temperatures
measures temperature at a point
electronic output
more robust
measures temperatures at a distance (**not** more sensitive) ANY 2 lines B2 [2]

(e) (i) (Q =) Pt **or** 80 × 5 × 60 **or** 80 × 5 **or** 400 **or** 300 (s) seen C1
24000 J cao A1 [2]

(ii) (Q =) $mc\Delta T$ **or** 1.8 × 390 × T = 24000 in any form ecf **(i)** C1
34°C (**accept** 34.188, 34.18, 34.19, 34.2) A1 [2]

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10 (a) (master cylinder creates) **pressure** in brake **fluid or** pressure from master piston transmitted to slave piston B1
fluid/pressure produces **force/push** (not press) (on slave piston) **or** force from master piston transmitted (to slave piston) B1 [2]

(b) (i) P = F/A **or** 140/2.0 C1
70 (N/cm^2) A1 [2]

(ii) 70 × 2.8 C1
200 N **accept** 196 N ecf **(i)** A1 [2]

(iii) distance foot to pivot larger than piston to pivot B1
force × distance constant B1 [2]

(c) (i) molecules hit against walls/piston (**ignore** hit each other) B1 [1]

(ii) hit more often/more frequently (**accept** hit each other more often) B1
smaller volume **or** molecules closer/less space B1 [2]

(iii) $P_1V_1 = P_2V_2$ **or** PV = constant B1
$1 \times 10^5 \times 6$ (×2) = P × 4 × (2) C1
1.5×10^5 Pa A1 [3]

(d) air/bubbles compress/reduce in volume **or** brakes pushed further/spongy B1 [1]
ignore: efficiency; less pressure; less force transmitted

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11 (a) electron B1
negative B1
electromagnetic (high frequency wave/particle/photon) B1
neutral/none B1 [4]

(b) (i) time taken to halve M1
activity **or** number of atoms/nuclei **or** count (rate)
(**ignore** radioactivity/mass/volume/amount/number of particles/molecules/ a nucleus to halve) A1 [2]

(ii) alpha stopped by body/flesh/skin **or** cannot penetrate body/skin **or** causes damage to body (1 max for damage) B1
gamma penetrates body/not absorbed **or** can be detected outside body **or** causes less/no damage to body (1 max for damage) B1 [2]

(iii) takes time for isotope to spread/investigation/experiment (so 6 min too short) B1 [1]

(iv) radioactive for longer/more dangerous/more damage/causes damage B1 [1]

(c) (i) (radioactive emission is) random B1 [1]

(ii) 3200 seen (as average) C1
attempt to halve e.g. 3202 → 1601 **or** 4 half-lives C1
52 hours A1 [3]

(iii) rocks/cosmic rays/radon gas/nuclear fall out B1 [1]

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