

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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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) $9.8-10 \text{ m/s}^2$ B1 [1]
- (ii) $a = v(-u)/t$ algebraic or numerical C1
 $2(.0) \text{ m/s}$ 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** $6 \times 2/4$ **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 $\times$ 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)
blue below red **and** blue and red diverge B1 [2]
B1
- (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
correct curvature **from origin** with decreasing gradient C1
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** $1600 \times (i)$ 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 ($>0.6V$) 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
 connected to meter/ammeter/galvanometer/voltmeter M1
 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** $80 \times 5 \times 60$ **or** 80×5 **or** 400 **or** 300 (s) seen C1
 24000 J cao A1 [2]
- (ii) $(Q =) mc\Delta T$ **or** $1.8 \times 390 \times T = 24000$ in any form ecf (i)
 34°C (**accept** 34.188, 34.18, 34.19, 34.2) C1
 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
 $70 \text{ (N/cm}^2\text{)}$ 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 $\times$ 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** $PV = \text{constant}$ B1
 $1 \times 10^5 \times 6 (\times 2) = P \times 4 \times (2)$ C1
 $1.5 \times 10^5 \text{ Pa}$ 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]