

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education O Level

MARK SCHEME for the JUNE 2005 question paper

5054 PHYSICS

5054/02

Paper 2 (Theory), maximum mark 75

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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June 2005

GCE O Level

MARK SCHEME

MAXIMUM MARK: 75

SYLLABUS/COMPONENT: 5054/02

**PHYSICS
Paper 2 (Theory)**



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Section A

- 1 (a) arrow from Earth to Sun (by eye would pass through Sun) **B1**
- (b) (i) use of circumference/time **or** $s=d/t$ **or** radius/t **C1**
two speeds **clearly** found using circumference e.g. 970 and 942
(allow conversion to other units) **A1**
- (ii) 258 (million km) **B1 4**
- 2 (a) straight line through optical centre by eye **M1**
one other line from same point on object correctly to image on film **A1**
- (b) move lens towards object/to left/away from film **B1**
- (c) **1st and 2nd face** correct refraction for all rays shown **B1**
dispersion into at least two rays at first face only **B1**
colours marked on diverging rays outside prism
(any 2 visible colours from spectrum, any order, accept letters) **B1 6**
- 3 (a) (i) (molecules) hit the wall/cylinder **B1**
any other point to explain large pressure, e.g. small distance between
molecules **or** hit often/frequently **or** many hit walls each sec **or** hit/move fast **B1**
- (ii) greater distance between molecules **or** fewer hit (per sec) **or** fewer molecules
(in cylinder) **or** molecules leave cylinder **B1**
- (b) $P_1V_1 = P_2V_2$ **or** $PV = \text{constant}$ **B1**
0.002. 200 = 1. V or 0.4 seen **C1**
0.398 **or** 0.4 m³ **A1 6**
- 4 (a) in river/(emerging from or entering) turbine house **B1**
- (b) (i) 0.9 **or** 90% **or** 0.47 **or** 47% (penalise unit error) **B1**
- (ii) $P = E/t$ in symbols **or** any energy/any time **C1**
30 x 60 **or** 1800 seen **C1**
 2.5×10^6 (W)
(150 or 2.78MW score 2/3) **A1**
- (c) any sensible suggestion e.g. no costs for water/energy supply
or less pollution (accept coal produces smoke/dust/harmful gases/CO₂)
or no need to transport coal **or** renewable
or rapid response to power demand **or** less heat produced/more efficient **B1**
- (d) any sensible suggestion e.g. flooding **or** fish unable to pass **or** turbines kill fish
or destroy habitats **or** less land **or** uses up large space **or** fells trees
or unsightly/destroys scenery **or** lake/river silt up **or** more rain/evaporation **B1 7**
- 5 (a) arrows in A and C to right **B1**
arrow in B to left **or** right if both A and C to left **B1**
- (b) (i) SNSN **or** NSNS **B1**

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- (ii) they/iron pieces attract/move together e.c.f. (i) throughout **B1**
attraction of opposite poles/unlike poles/S and N **B1**
- (c) (i) opposite direction/reverses/poles change **B1**
(ii) weaker (field) **or** (iron) demagnetises **B1 7**
- 6 (a) 3024 **B1**
3.024 (or 1/1000 of previous answer) **B1**
1.512 (or 1/2 of previous answer) **B1**
- (b) smaller resistance **accept** more current **B1**
- (c) heater uses more than 3A **accept** current 12.6A **B1**
causes fuse to melt/blow/burn/break **B1 6**
- 7 (a) arrow anticlockwise anywhere near top line of circuit **B1**
(b) LDR **or** light dependent resistor **B1**
(c) less resistance of X **B1**
same change in voltage as resistance
(voltage decreases alone B1) **B1 4**
- 8 (a) 4.5 V **B1**
(b) $I = V/R$ in any form using symbols or words **B1**
4.5/15 **C1**
0.3 A **A1**
(c) provides smaller (internal) resistance **or** lasts longer **or** less lost voltage
or one (cell) fails others work **or** less heat/energy lost **B1 5**

Section B

- 9 (a) (i) y axis labelled speed or m/s **and** x axis labelled time or s **B1**
straight line from 0,0 to $t = 20$, speed = 25 **B1**
uniform speed from $t = 20$ to 50 **and** uniform deceleration from $t = 50$ to 60 **B1**
- (ii) acceleration = change in velocity/time or per unit time
or rate of change of velocity with time
accept equation but must be written in words or defined symbols **B1**
- (iii) constant increase in speed/velocity in 1sec/ /same time interval
or rate of change of speed/velocity constant **or** Δv proportional to time
or acceleration constant **with time** **B1**
- (iv) 25/10 e.c.f. time interval from graph **C1**
2.5 m/s² accept -ve **A1**

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- (b) (i) weight/gravitational force (accept gravity) **downwards**
normal/reaction/contact force/force from ground **upwards**
air resistance/drag **or** friction (due to air) **backwards or** opposite to train
(direction)
braking force **or** friction **or** resistive force **backwards or** same direction as air
drag
tractive **or** thrust **or** driving force **or** force of engine **forwards**
ANY 4 **B4**
accept from diagram (-1 each wrong force more than 4)
- (ii) 1. unbalanced **since** forward force > backwards force **or** resultant/net
forward force **B1**
2. balanced **since** forward force = backwards force **or** forces cancel **or**
zero resultant **B1**
3. unbalanced **since** backwards force > forwards force **B1**
or only backwards force **or** resultant/net backwards force
accept sizes of forces from lengths of arrows on diagram
- (c) sketch graph with **axes labelled** and non straight line **B1**
- 10 (a) (i) 25% **B1**
- (ii) **conduction through roof**
particles/molecules/atoms vibrate (accept electrons move if roof metal) **B1**
(energy passed) from particle to particle (by collision)
or no net movement of medium **B1**
convection from roof
(warm) air (in contact with roof) expands (ignore particles expand) **B1**
(air) density decreases **B1**
hot air (not heat) rises **B1**
radiation from roof
sensible comment on radiation, e.g. infra-red, electromagnetic, a wave **B1**
- (iii) (carpet) traps air **B1**
carpet/air is a bad conductor/good insulator
or convection reduced **in trapped air** **A1**
- (b) (i) X = (\$) 800 **B1**
Y = (\$) 100 **B1**
- (ii) B (allow 1 mark for e.c.f. from (i)) **M1**
comparison of installation cost **or** energy saving/year **or** payback time **A1**
- (iii) walls thicker/cavity insulation/insulated/made from insulating material
floors thicker/made from insulating material (e.g. polystyrene, wood)
painting walls/roof white (inside or outside)
draught prevention/closing windows/closing doors/stop (hot) air escaping
using curtains/shutters
fewer windows/double glazing windows
reducing temperature inside house
(ignore insulating roof)
ANY 2, 1 from each line **B2**

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- 11 (a) (i) nucleus or small central area shown on diagram **M1**
 containing neutrons and protons **A1**
 electrons in orbits (accept shown on diagram around nucleus) **B1**
- (ii) emission of at least one of alpha/beta/gamma (radiation/particles)
 random or spontaneous (emission)
 from **unstable** atom/nucleus/substance **or** becomes stable ANY 2 **B2**
 from nucleus **B1**
- (iii) sensible statement but not just a list of the causes of background radiation
 e.g. unavoidable **or** naturally occurring **or** from surroundings/environment **or**
 present without source **or** there all the time etc. **B1**
- (iv) any halving **or** 820 **or** 419 **or** 410 **or** 223 **or** 209(.5) **or** 210 **or** 2 half lives
 seen **C1**
 205 **A1**
- (b) (i) 84 **B1**
 proton number increases by 1 **or** $n \rightarrow p + e$ **or** correct equation with ${}_{-1}\beta$ or ${}_{-1}e$ **B1**
- (ii) alpha **B1**
 loses two protons or proton number or atomic number decreases by 2 **B1**
 loses two neutrons or nucleon number or mass number decreases by 4 **B1**
- (iii) different proton numbers **B1**

Max 1 unit penalty per question. No significant figure penalties.