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**

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

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.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

June 2005

GCE O Level

MARK SCHEME

MAXIMUM MARK: 75

SYLLABUS/COMPONENT: 5054/02

PHYSICS
Paper 2 (Theory)

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 = constant	**B1**	
		0.002. 200 = 1. V or 0.4 seen	**C1**	
		0.398 **or** 0.4 m^3	**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/CO_2 **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**	

(ii) they/iron pieces attract/move together e.c.f. **(i)** throughout
attraction of opposite poles/unlike poles/S and N

(c) (i) opposite direction/reverses/poles change **B1**

(ii) weaker (field) **or** (iron) demagnetises **B1** **7**

6 **(a)** 3024 **B1**
3.024 (or1/1000 of previous answer) **B1**
1.512 (or ½ 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/s^2 accept -ve **A1**

(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 **or** only backwards force **or** resultant/net backwards force **B1**
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 ANY 2, 1 from each line **B2**
(ignore insulating roof)

11 (a) (i) nucleus or small central area shown on diagram
containing neutrons and protons
electrons in orbits (accept shown on diagram around nucleus) **B**

(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 -> 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.