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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education O Level

MARK SCHEME for the June 2004 question papers

5054 PHYSICS

5054/01	**Paper 1 (Multiple Choice), maximum mark 40**
5054/02	**Paper 2 (Theory), maximum mark 75**
5054/03	**Paper 3 (Practical Test), maximum mark 30**
5054/04	**Paper 4 (Alternative to Practical), maximum mark 30**

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do 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 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

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JUNE 2004

GCE O Level

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 5054/01

PHYSICS
Paper 1 (Multiple Choice)

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Question Number	*Key*	*Question Number*	*Key*
1	**A**	21	**A**
2	**A**	22	**D**
3	**C**	23	**C**
4	**D**	24	**A**
5	**C**	25	**C**
6	**D**	26	**B**
7	**C**	27	**B**
8	**A**	28	**D**
9	**D**	29	**B**
10	**A**	30	**A**
11	**C**	31	**B**
12	**B**	32	**D**
13	**A**	33	**D**
14	**A**	34	**B**
15	**D**	35	**C**
16	**B**	36	**A**
17	**B**	37	**A**
18	**B**	38	**D**
19	**D**	39	**A**
20	**C**	40	**B**

TOTAL 40

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JUNE 2004

GCE O Level

MARK SCHEME

MAXIMUM MARK: 75

SYLLABUS/COMPONENT: 5054/02

PHYSICS
Paper 2 (Theory)

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Section A

1	**(a)**	**(i)**	weight / gravity / gravitational (force)	
		(ii)	**air / wind** resistance or drag or friction / upthrust	B1
	(b)	**(i)**	9.8 or 10 m/s^2 or N/kg	B1
		(ii)	air resistance increases (**not** if parachute open)	B2
			less resultant force **or** sensible statement about upwards force	C1
			e.g. resistance opposes gravity or decreases acc.	C1
			slope of line decreases	C1
		(iii)	air resistance = weight / no **resultant / net / overall** force / downwards force balances upwards force	B1
			Total	**[6]**
2	**(a)**	**(i)**	radiation	B1
		(ii)	no molecules or medium (to vibrate, conduct, convect) / vacuum	B1
	(b)		**hot air** rises	B1
			(hot) air expands / density decreases	B1
	(c)		fiberglass or air is a bad conductor/ insulator / lags / reduces heat flow	
			fiberglass traps air or prevents convection	B1
			(ignore radiation statements)	B1
			Total	**[6]**
3	**(a)**		rise in temperature / hot / heated	B1
			road / bridge / rail / metal expands or gap reduces	B1
			no buckling / deformation / breaking / cracking / twisting / tilting	B1
	(b)		any **other** problem + solution e.g. concrete cracks – leave a gap, telephone wires sag – put them high / tight hot water cracks glass – use thin glass / car engines seize up – cool them water freezes in pipes – lag them or use antifreeze / tyres burst – let air out pipes bend – use **flexible** joints / dashboard deforms – car in shade wrong readings on measuring cylinder – use correct temp.	B1
			Total	**[4]**
4	**(a)**		distance traveled per unit time **or** in one second / distance ÷ time **or** rate of change of distance	B1
	(b)		s = d/t in any algebraic or numerical form	C1
			any doubling of distance or final time	C1
			0.48 s (allow 0.24s 2/3 accept 0.5s)	A1
	(c)		60/0.48 (5)	C1
			123.75 accept 120, 123, 124 (ecf **(b)**)	A1
			Total	**[6]**
5	**(a)**	**(i)**	magnetic (field) of current / coil / recording head or head is magnetized / an electromagnet	B1
		(ii)	magnetism / magnetic field or current or poles on head reverses / changes direction (**accept** "due to alternating current")	B1
		(iii)	each direction / one cycle longer (on tape)	B1
	(b)	**(i)**	need to keep record / tape stored or played	B1
		(ii)	iron, steel etc	B1
			Total	**[5]**

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6	**(a)**	**(i)**	voltage past maximum or 3V / off scale / outside range	
		(ii)	reading less accurate or sensitive / not far up scale or smaller deflection	
	(b)	**(i)**	V = I R in any algebraic format	
			4/12	C1
			0.33 A (accept 1/3 A)	A1
		(ii)	**(i)** * 30 **or** **(i)** * 18 + 4 **or** 30*4/12	C1
			9.9 – 10 V (e.c.f **(i)**, e.g. if **(i)** = 0.3, 0.3*30 = 9V or 0.3*18+4 = 9.4 V)	A1
			only 1 unit error in this question	
			Total	**[7]**
7	**(a)**	**(i)**	filament is hot / heated (by current from 6V supply) / thermionic emission	B1
		(ii)	anode is positive / anode attracts electrons / electrons attracted to + (electric) field from anode to cathode	B1
		(iii)	otherwise electrons stopped / deflected / slowed down / collide (with air atoms) (accept no opposition to movement, to reach screen, to avoid air resistance)	B1
	(b)		up and down vertical **or** side to side movement (**not** on both axes)	B1
			electrons deflected by electric field **or** attracted to + or repelled by – **or** plates are charged (e.g. plates are +ve and –ve)	B1
			Total	**[5]**
8	**(a)**		radon (gas)	B1
	(b)		cancer / mutation / **cell** damage **or** death **radiation** sickness **or adds** to readings (accept count with no source)	B1
	(c)		(outer) space / stars / Sun (**not** sunlight)	B1
	(d)		number of protons and neutrons (**not** no. nucleons)	B1
	(e)		84 216 (values reversed B1)	B2
			Total	**[6]**

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SECTION B

9	(a)	(i)	Any three other parts of spectrum radio, microwaves, u.v., X, γ	
			(-1 any wrong if>3 **ignore** t.v.)	
			correct order for all including visible (accept colours) and I.R.	A
		(ii)	reflection **of infra-red or radiation** (from shiny material)	B1
			more energy hits food **or** reflection towards food	
			cooks food faster	
			avoids wasting heat / energy **or** more efficient	
			avoids heating outer case or burning hand ANY 2	B2
	(b)		connected to (outer metal) case	B1
			if live touches case **or** case becomes live	B1
			allows current / charge to earth / ground	B1
			blows fuse (and disconnects circuit)	
			or no current through person **or** no electrocution / electric shock	B1
	(c)	(i)	P = V I in any algebraic form	B1
		(ii)	230 * 8.3	C1
			1900 W (accept 1910 W but **not** power 1/4)	A1
		(iii)	current decreases (halves) **or** power 1/4	B1
			Total	**[15]**
10	(a)		mass of bar (measured)	M1
			using (top-pan) balance / spring balance / scales etc.	A1
			length, breadth and height measured	
			or volume water + bar measured **or** displacement can (full) with water	M1
			volume = length x breadth x height	
			or subtract volume water alone **or** collect water displaced	A1
			using ruler / calipers / micrometer **or** measuring cylinder	A1
			density = mass / volume	B1
	(b)	(i)	melts / changes state / becomes liquid	B1
		(ii)	(initial) increase in vibration / K.E. of molecules (to 600s)	B1
			then later / after 600s or on melting	
			bonds broken (accept molecules break free / overcome attraction / not fixed in place)	B1
		(iii)	E = mc (Δ)T algebraic form seen	C1
			645 – 655 (°C) seen)	C1
			17 160 J (allow 1700, 17200, 20000)	A1
		(iv)	30*400 or 12 000 (J) seen)	C1
			E = mL any algebraic form seen **or** 12 000/0.3	C1
			40 000 J/kg	A1
			Total	**[15]**

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11	(a)	(i)	P.E. decreases (A to B or C to D or downhill or initially)	
			K.E. gained (P.E. → K.E.…2)	
			K.E. to P.E. **change** must be clear and from B to C or uphill	
		(ii)	mgh algebraic form seen	C1
			500*10*30	C1
			150 000 J	A1
		(iii)	conservation of energy cited **or** clear that loss of P.E. has become K.E.	C1
			500*10*20 or 500*10*10 or 50 000 seen	C1
			100 000 J (allow g=9.8)	A1
	(b)	(i)	velocity involves direction **or** is a vector (speed does not)	B1
			direction (of carriage) changes / carriage turns (accept on diagram)	
		(ii)	force towards centre (of curve) / inwards (accept centripetal)	B1
	(c)		F = ma in any algebraic form or 3000 = 500a	C1
			3000/500	C1
			6(.0) m/s^2	A1
			Total	**[15]**

Total for paper : **[75]**

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JUNE 2004

GCE O Level

MARK SCHEME
MAXIMUM MARK: 30
SYLLABUS/COMPONENT: 5054/03 **PHYSICS** **Paper 3 (Practical Test)**

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1. (a), (b) & (c) Repeat measurements taken for either t_1 or t_2. B1

Correct T_1 in the range 1.40 s to 1.60 s to 0.01 s B1

Correct T_2 within $\pm$ 0.1 s of T_1 B1

(d) Comment on
Either reaction time – however expressed
Or range of values B1

(e) Sensible conclusion based on their results e.g.
Time for one oscillation is independent of the mass.
(if periods are the same within the limits of uncertainty)
Or Time for one oscillation increases / decreases with increase in mass. (Allow direct or inverse proportion)
(provided their results show this) B1

Total [5]

2. (a) Power supply, ammeter and switch in series with gap between A and B, voltmeter in parallel with power supply. B1

(b), (c) & (d) I values in region of 0.3 A and 0.45 A with unit seen at least once and at least one current to 0.01 A. B1
(Allow Centre variation)
Both V values in the region of 4.5 V with unit seen at least once and at least one voltage to 0.1 V. B1
(Allow Centre variation)
R values in the region of 15 Ω and 10 Ω with unit seen at least once. B1

(e) Resistance increases as diameter decreases. B1
(Allow resistance is inversely proportional to diameter or area)

Total [5]

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3. (a) and (b) Sensible temperatures with unit seen at least once. B

At least one reading attempted to better than 1 ˚C B1

V_F numerically to (1.0 to 3.0) x temperature drop
and correct calculation of V_I with unit seen at least once.
m_I numerically equal to V_I. B1

(c) and (d) Sensible values for all the thermal energy changes with unit seen at least once. M1

(e) Energy gained greater than energy lost as cold water gains thermal energy from beaker / surroundings A1

Total [5]

4. **Initial readings.**

(b) x 0.60 ± 0.05 m with unit. B1

(c) y 0.20 ± 0.05 m with unit. B1
(Penalise missing unit once only)
x and y recorded to 0.001 m or better. B1

Table

(d) Table with units for d, D and $1/D$. B1

At least one reading with D greater than or equal to 1.00 m. B1

At least one reading with D less than or equal to 0.70 m B1

Correct calculation of $(d/D)^2$ and $1/D$ to at least 2 s.f. B1

Five good values judged according to the table below. B1

D	Range of $(d / D)^2$	$1 / D$
0.65	0.06 – 0.10	1.54
0.70	0.12 – 0.16	1.43
0.75	0.18 – 0.22	1.33
0.80	0.23 – 0.27	1.25
0.85	0.27 – 0.31	1.18
0.90	0.31 – 0.35	1.11
0.95	0.35 – 0.39	1.05
1.00	0.38 – 0.42	1.00

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Graph.

(e)	Axes labelled with unit and correct orientation.	B1
	Suitable scale y axis 1 cm = 0.02 / 0.025 x axis 1 cm = 0.1 or 0.05 m^{-1}	M1
	Two points plotted correctly – check the two points furthest from the line.	A1
	Best fit fine line and finely plotted points.	B1

Calculations.

(f) and (g)	Large triangle.	B1
	Correct calculation of *S* and *f* (ignore sign)	B1
	Value of *f* in range 0.130 m to 0.170 m with unit.	B1

Total [15]

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GCE O Level

MARK SCHEME

MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 5054/04

PHYSICS
(Alternative to Practical)

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Question 1

(a) Uses two rays from X and Y (clear *intention* to touch hole edges) M1
One X and one Y ray "touch" an edge of the hole and meet screen C1
Any one X and one Y are neat lines (rule and sharp "pencil") allow apparent "refraction" or "diffraction" at hole B1
One correct X and the corresponding Y labeled on screen
Arrows on rays; no broken lines penalty -1 (max). B1

(b) XY in range 54 to 56 mm (unit required), accept in cm B1

Total [5]

Question 2

(a) 4 items correct, 3mks; 3 items = 2mks; 2 items = 1mk. Accept historical symbols
Accept any other component provided that the function of the circuit is not compromised.
Penalise -1 (max) :- short circuit (e.g. line behind component, unless signs of use of rubber) or any compromised circuit function. B3

(b) Correct polarities, +ve signs for correct terminals of cell and ammeter (re diode). B1

(c) No current / $I = 0$, (do not accept "nothing"), accept very small "reverse" current / lamp does not light. B1

(d) One from: limit current / prevent overheating / current indicator / provides resistance B1

Total [6]

Question 3

(a) Any method based on rule reading at 25°C – rule reading at top of thermometer bulb.
NB l required. Mark text or diagram or Fig 3.1 B1
Rule as close as possible to thermometer (on diagram < 1 cm) / uses fiducial aid B1
With the eye/line of sight perpendicular to the rule/end of mercury thread B1

(b) (i) l_0 = 5.6 – 5.8 (cm), l_{100} = 22.6 – 22.8 (cm) ignore unit B1
(ii) Δl / 100, clear, correct arithmetic ecf, 2 or 3 dcp, ignore unit, accept any correct $\Delta l / \Delta\theta$ from graph. B1
(iii) linearly, or $(l - l_0) \propto \theta$ accept/line has a constant/uniform m, note that… "directly proportional" automatically looses the mark. B1

Total [6]

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Question 4

(a) (i) V initial = a volume between 40cm^3 and 60cm^3 : (allow use of beaker) B1
must be able to displace 40cm^3 / prevents overflowing / exceeding cm^3 limit B1

(ii) $\{V_{max} - V_{initial}\}$ / change in volume is found / change in volume obtained is $= V_{metal}$ / any related answer that has an association of measurement of volume. B1

(iii) Any good point e.g. tap cylinder to release air / how avoiding parallax / water at 20°C / careful pouring / avoid splashing / use set square / repeat average / reading the position of the bottom of the meniscus. B1

(b) Scale calibration of cylinder is correct at 20°C / liquid needs to be at 20°C B1

(c) Water (on the metal would be) included in the (repeat) volume of the metal; or something that means the same, not just erroneous. B1

Total [6]

Question 5

(a) Axes correct, scale that cannot be x2 / is not "awkward" and with units B1
Correct plotting, nearest ½ small square, check first point and obvious plot errors. B1
Line judgement re plots (line does not go through all correctly plotted points, so accept smooth line through 5 points i.e., one point not on the line) B1
Neat smooth thin line B1

(b) Mark cands diagram <u>or Fig 5.1:</u>
(i) Object displace downwards OR screen displaced downwards B1
Any ray from the top of object through the lens to meet screen.
Be generous re art and accuracy of position, B1
(ii) put centres in line B1

Total [7]

Paper Total 30

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