UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary and Advanced Level

MARK SCHEME for the June 2005 question paper

9702 PHYSICS

9702/06

Paper 6, maximum mark 40

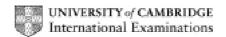
This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking 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.



Grade thresholds for Syllabus 9702 (Physics) in the June 2005 examination.

	maximum	minimum mark required for grade:			
	mark available	А	В	Е	
Component 6	40	26	23	14	

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

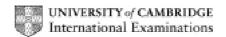
GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 9702/06

PHYSICS Paper 6



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Option A - Astrophysics and Cosmology

position: on a spiral arm, between ½ and ¾ distance from centre **B1** [1] (a) (i) allow 80 000 \rightarrow 150 000 light-years (b) **B1** (ii) allow 2 → 10 light-years **B1** [2] (c) allow $10^7 \rightarrow 10^9$ **B1** [1] allow $10^8 \rightarrow 10^{10} \,\mathrm{K}$ (a) 2 **B1** [1] position marked between 10¹² s and 10¹³ s (b) В1 [1] **B1** result of X-bosons (allow 'bosons') (c) at (very) early stages of development of the Universe **B1** (X-) boson decays into quarks **M1** (slightly) more slowly than its antiparticle decays **A1** [4] 3 (a) (i) $H_0 = (60 \times 10^3)/(3.1 \times 10^{16} \times 10^6)$ **C1** $= 1.9 \times 10^{-18} (s^{-1})$ C1 age of Universe = $1/H_0$ (or clear substitution for H_0 shown) **B1** $= 5.2 \times 10^{17} \text{ s}$ **C1** $= 1.6 \times 10^{10} \text{ years}$ **A1** [5] (ii) fraction of time = $(12600 \times 10^6)/(1.6 \times 10^{10})$ = 0.79 or 63/80**A1** [1] (iii) light left galaxy when Universe was much younger **B1 B1** (so) 'looking back' in time [2] limit set by how far light can travel М1 during the lifetime of the Universe Α1 or galaxies at very large distances are moving very fast so Doppler shifted out of visible [2] Option F - The Physics of Fluids (a) pressure difference (between upper and lower surfaces) **B1** [1] allow 'upthrust provided by displaced fluid' **C1** (b) (i) mass = density \times volume $= 920 \times 6.4 \times 10^4 \times (28 + d)$ **A1** [2] (ii) either $920 \times 6.4 \times 10^4 \times (28 + d)$ or $1030 \times 6.4 \times 10^{4} \times d$ Α1 [1] (i) $920 \times 6.4 \times 10^4 \times (28 + d) = 1030 \times 6.4 \times 10^4 \times d$ **C1** (c) d = 234 m**A1** [2] (ii) fraction = 234/(234 + 28)= 0.89**A1** [1]

Page 2		ge 2	Mark Scheme	Syllabus	Papei	•
		9 -	GCE A/AS LEVEL – JUNE 2005	9702	6	
5	(a)		nich there is internal friction isting motion of an object through the fluid		B1	
			g movement between layers of fluid		B1	[2]
	(b)	(do not all	o single value for the speed in the pipe low unqualified 'constant')		B1	
			comment e.g. volume flow rate takes into account whole	flow	B1	[2]
	(c)		ure (= ρgh) = 1.0 × 10 ³ × 9.8 × 9.1 × 10 ⁻² = 890 Pa		M1 A0	
		(ii) 1.5 ×	explanation as to why this is the pressure difference $10^{-6} = (\pi \times \{0.9 \times 10^{-3}\}^4 \times 890)/(8 \times \eta \times 13 \times 10^{-2})$		B1 C1	[2]
		$\eta = 1$	$1.18 \times 10^{-3} \text{ N s m}^{-2}$		A 1	[2]
6	(a)	(ii) each	aken by a particle of the fluid particle can follow only one path terms of tangent being direction of motion, and only one c	lirection)	B1 B1	[1] [1]
	(b)	when line	be of flow) Av = constant s converge, A becomes smaller st increase		M1 A1 B1	[3]
Op	otion	M - Medica	al Physics			
7	(a)	pulse of ra Causes H H-atoms of RF detect to give po non-unifo	orm magnetic field applied (to patient) adio-frequency waves I-atoms in patient to resonate or vibrate at Lamour frequency off radio-frequency waves and processed asitions of H-atoms arm magnetic field enables of resonating atoms to be defined	(1) (1) (ncy (1) (1) (1) (1)		
		P	[1 each, any five]	(-)	B5	[5]
	(b)	•	portability of equipment, time taken ible suggestions, 1 each, max 2]		B2	[2]
8	(a)	``	y deposited <u>in body</u> nit mass of (body) tissue		M1 A1	[2]
		(ii) effects	s depend on <u>density</u> of deposition of energy/ionisation radiations cause greater density of ionisation than others		B1 B1	[2]
	(b)		has long-term effects		<u> </u>	r-1
	()		relevant point e.g. life shortening, hereditary, cancer indu	icing	A 1	[2]
9	(a)	` '	x/converging ength (= 100/2.5) = 40 cm		B1 B1	[1] [1]
	(b)	(ii) far po			B1 B1 B1 C1	[1]
			is 67 cm in front of the eye		A1	[4]

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Option P - Environmental Physics

10 (a)	resources: total energy available/stored in Earth reserves: total energy that can be extracted (economically)		
	reserves less than resources because some fossil fuels not recoverable/too expensive		[3]
(b)	formation takes place over millions/thousands of years fossil fuels will be exhausted in much less time than this	B1 B1	[2]
11 (a)	induction compression power EXHAUST open CLOSED CLOSED closed open [each column 1 mark, max 4]	В4	[4]
(b)	(i) power is delivered (by a cylinder) on every stroke (so) smoother power output/torque(ii) improved flow of gases (in and out of cylinder) increases efficiency of engine	M1 A1 M1 A1	[2] [2]
12 (a)	 (i) any agent/substance/waste that is detrimental to health or the environment (ii) 1 man-made: e.g. exhaust gases from cars (anything sensible) 2 natural: e.g. volcanic emissions (anything sensible) 	B1 B1 B1 B1	[2] [2]
(b)	carbon dioxide absorbed (by plants) with release of oxygen (transpiration) replaces water vapour (in atmosphere) either increasing CO ₂ levels would cause temperature changes or anything sensible e.g. reference to biodiversity, weather patterns		
Option	T - Telecommunications		
13 (a)	signal sampled at regular intervals signal voltage converted to a digital number transmitted as a series of groups of pulses pulses could be IR pulses in optic fibre (allow any sensible example) any other relevant physics	B1 B1 B1 B1	
4.	(e.g. sample at twice max frequency, use parallel to series converter)	B1	[5]
(b)	e.g. can be regenerated to remove noise data can be added to check for/correct errors [anything sensible, 1 each, max 2]	В2	[2]
14 (a)	(i) loss of energy/power (in the signal)(ii) unwanted (random) signal	B1 B1	[1] [1]
(b)	(i) power/dB = $10 \lg(P_1/P_2)$ $25 = 10 \lg (P/(6.0 \times 10^{-19}))$ $P = 1.9 \times 10^{-16} \text{ W}$ (ii) allowable loss = $10 \lg(7.0 \times 10^{-3})/(1.9 \times 10^{-16})$ = 136 dB length = $136/1.7 = 80 \text{ km}$	C1 M1 A0 C1 C1 A1	[2] [3]
(c)	signal amplifier/re-shaper at intervals along the fibre	B1	[1]

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(d)	(i)	remains at one point above the Earth orbits Earth above the Equator period of orbit is 24 hours	(1) (1) (1)		
		rotates from west to east	(1)		
		[any two, 1 each]		B2	[2]
	(ii)	for satellite, time to travel $(2 \times 3.6 \times 10^4 \text{ km}) = 0.24 \text{ s}$		B1	
		for fibre, time to travel 18000 km = $0.06 \text{ s} \rightarrow 0.09 \text{ s}$		B1	
		advantage: less built-in delay for conversation		B1	[3]