UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS GCE Ordinary Level

## MARK SCHEME for the October/November 2010 question paper

## for the guidance of teachers

## **5054 PHYSICS**

5054/21

Paper 2 (Theory), maximum raw mark 75

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

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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Page 2			2 Mark Scheme: Teachers' version Syllabus			Paper	
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			Section A				
1	(a)	(i)	any	one time between 1.60 and 2.50 s or range of correct	values	B1	[1]
		(ii)	any	one time between 0.75 and 1.65 s or range of correct	values	B1	[1]
		(iii)	2.5(0	0) s		B1	[1]
	(b)		area 2.7(3	a (under graph) <b>or</b> ½bh <b>or</b> ½gt <sup>2</sup> <b>or</b> ½ × 0.75 × (7.3 to 7 375) to 2.8(125) m	.5)	C1 A1	[2]
2	(a)		grav of th	ritational/centripetal (pull/attraction) e <b>Sun</b>		B1 B1	[2]
	(b)	(i)	arrov exte	w touching Venus towards centre/left (must pass throu nded)	gh Sun if	B1	[1]
		(ii)	(F =) 4.8(4	) <i>ma</i> <b>or</b> 4.9 × 10 <sup>24</sup> × 9.7 × 10 <sup>−3</sup> 4.753) × 10 <sup>22</sup> N		C1 A1	[2]
	(c)		direc force <b>any</b>	ction of movement	<b>or</b> does not move	C1 A1	[2]
3	(a)		ener ener <b>or</b> (r	rgy cannot be created/destroyed (nb. only one required rgy cannot be destroyed or created (i.e. the other one a merely) transformed <b>or</b> total energy in an isolated syste	l) as well) em is constant	B1 B1	[2]
	(b)	(i)	cher to el	mical (potential) <b>at beginning</b> lectrical (and heat) <b>at end</b> others present	:: max 1	B1 B1	[2]
		(ii)	light heat	t/thermal/internal others present:	max 1	B1 B1	[2]
	(c)		less or le or le	heat; same light ess chemical/electrical; less heat ess chemical/electrical; same light		B2 B2 B2	[2]
4	(a)	(i)	e/m	waves can travel/satellite in a vacuum/space		B1	[1]
		(ii)	micr	owave/radio wave (region)		B1	[1]
		(iii)	grea	ater coverage/less ground-based infrastructure/less ob	struction	B1	[1]
	(b)		(x =) 7.2 >	) <i>vt</i> <b>or</b> 3.0 × 10 <sup>8</sup> × 0.24 × 10 <sup>7</sup> m <b>or</b> 72 000 km		C1 A1	[2]

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Page 3			Mark Scheme: Teachers' version	Syllabus	Paper		
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5	(a) (i)	( <i>P</i> = 420	) <i>VI</i> or 12 × 35 W or J/s		C1 A1	[2]	
	(ii)	(Q = 12 × 5.0(4	e) <i>Pt</i> or <i>VIt</i> or 12 × 35 × 2 or 420/ecf (i) × 2 35 × 120 or 420/ecf (i) × 120 4) × 10 <sup>4</sup> J		C1 C1 A1	[3]	
	(b) (i)	( <i>m</i> = 150/	e) Q/l <sub>f</sub> <b>or</b> 5.04 × 10 <sup>4</sup> /330 153/152.7272) g <b>or</b> 152 g from 5.0 × 10 <sup>4</sup> J		C1 A1	[2]	
	(ii)	heat (i.e. ice b	lost to <b>glass/air/wires/water/surroundings</b> specified heat loss) below 0°C		B1 B1	[2]	
6	(a) (i)	curre	rrent in magnetic field <b>or</b> motor effect/LH rule <b>or</b> coil is magnet		B1		
		(proo repu force	duces) force <b>or</b> current <b>direction</b> changes <b>or</b> coil move Ilsion <b>and</b> attraction e changes direction/backwards and forwards	es or	B1 B1	[3]	
	(ii)	air (a	atoms/molecules/particles) (next to cone) vibrates		B1		
		com or vi	ompressions and rarefactions or high and low pressure r vibrations passed on or longitudinal		B1	[2]	
	(b)	the r	note is louder/has greater intensity ( <b>not</b> changed free	quency)	B1	[1]	
7	(a) (i)	p.d. the c	rises capacitor charges/at a decreasing rate/to a maximum v	value	B1 B1	[2]	
	(ii)	it tak <b>or</b> co	xes a certain time/200 s to reach certain charge/p.d. ertain charge/p.d. activates alarm		B1	[1]	
	(b)	(I =) 2.7(0	0 <i>Q/t</i> <b>or</b> 5.4 × 10 <sup>-7</sup> /200 0) × 10 <sup>-9</sup> A		C1 A1	[2]	

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	Pa	ige 4	4 Mark Scheme: Teachers' version	Syllabus	Paper				
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	Section B								
8	(a)	(i)	( <i>W</i> =) <i>mg</i> <b>or</b> 70 × 10 <b>or</b> 70 × 9.8(1) etc. 700(.0) N		C1 A1	[2]			
					_				
		(ii)	(P =) F/A  or  700/35		C1				
			$700/(35 \times 4)$ or $700/0.0035$ or $700/(0.0035 \times 4)$		Δ1 Δ1	[3]			
			50 000 Fa <b>01</b> 50.0 KFa <b>01</b> 5.0 N/Cm		AI	[3]			
	(b)	(i)	molecules/atoms/particles move or collide		B1				
			molecules/atoms/particles collide with cylinder/walls		M1				
			exert force on walls (as they collide)	<u>ب</u>	A1 D1	[A]			
			spread out effect (of forces) is pressure or (force)/m or simila	Γ	ы	[4]			
		(ii)	molecules/atoms/particles closer/denser/more in given volume	)	C1	101			
			more collisions per (unit) area/m <sup>2</sup> or per (unit) time/s (not faste	∍r)	A1	[2]			
	(c)	(i)	speed (of molecules/atoms/particles) increases/k.e. increases		B1	[1]			
		<i></i>			54				
		(11)	car (body) higher (off the ground)		B1				
			fewer collisions of molecules/atoms/particles needed or press	uro risos	DI				
			initially		B1	[3]			
						[-]			
9	(a)	(i)	horizontal ray from Q to pool edge <b>and</b> on to P from corner		B1				
			critical angle marked C or obvious		B1	[2]			
		(ii)	for $i = 90^{\circ}$ or horizontal ray		B1				
			angle(in water) equals/cannot be less than critical/C		B1	[2]			
		(iii)	( <i>n</i> =) sin <i>i</i> /sin <i>r</i> <b>or</b> 1/sin <i>C</i> <b>or</b> 1/ <i>n</i> = sin <i>C</i> <b>or</b> sin 90°/sin 49°						
			or 1/sin 49°		B1				
			1.3(2501)		B1	[2]			
		(iv)	decreases		B1	[1]			
		(••)			ы	[']			
	(b)	(i)	any <b>two</b> of:						
	(~)	(-)	real						
			less bright						
			further from lens						
			beyond 2f		B2	[2]			
		(ii)	straight ray from R to <b>top</b> of image		B1	[1]			
		(iii)	where ray crosses principal axis, vertical line (L or drawn lens)	)	B1	[1]			
		(iv)	paraxial ray from R to lens refracted to top of image						
		. ,	or paraxial ray from lens to top of image, traced back to R		M1				
			F marked		A1	[2]			
		( <b>)</b>	16 10 on an ottomat to use 1/4 + 1/4		C1				
		(v)	1.0 - 1.9 cm or allempt to use $1/u + 1/v19 - 23 cm (2 sig fig only)$		Δ1	[2]			
					, , , ,	[~]			

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Page 5			Mark Scheme: Teachers' version	Syllabus	Pape	Paper			
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10 (a)	(i)	15			B1	[1]			
	(ii)	32			B1	[1]			
(b)	(i)	$^{32}_{15}{ m P}$	$(\rightarrow)$		B1				
		supe	erscripts: 32 on S <b>and</b> 0 on beta (allow e)		B1				
		subs	scripts: 16 on S <b>and</b> -1 on beta (allow e) (just	<sup>32</sup> <sub>16</sub> S 1/2)	B1	[3]			
	(ii)	elec	tron		M1				
		high	speed or from nucleus or causes ionisation		A1	[2]			
	(iii)	reco	rd/measure background reading/count/radiation		B1				
		sam	ple near <b>named</b> detector		B1				
		inter inter <b>n b</b>	pose paper/card/less than 5 cm air <b>and</b> no change in pose 2 mm – 20 mm of aluminium <b>and</b> reading = bac points may be made on a diagram	reading ckground	B1				
		othe	r methods marked analogously		B1	[4]			
	(1)	timo	for some measurable quantity to belve		N/1				
(0)	(1)	num	ber of atoms/no. of nuclei/activity/count rate		A1	[2]			
	(ii)	350-	+1400 <b>or</b> ¼ <b>or</b> 2 (half-lives)		C1				
	( )	28.6	days		A1	[2]			
MARKI	NG	SCHE	ME CODE:						
B1	Ind	epen	dent Mark						
C1	Co	mpen	sation Mark:	a nood not ho so	on if the				
	answer is correct; also given if the answer is wrong but the point is seen in the working.								
M1	(Co	ompul	sory) Method Mark:		Ū				
۸ 1	if n	ot aw	arded subsequent A marks are lost (up to next B, M o	r C mark).					
C.a.o.	COr	rect a	inswer only (including unit)						
e.e.o.o.	ead	ch err	or or omission						
e.c.f.	erre	or car	ried forward:						
	it is i.e.	It is usually awarded even where not specifically indicated. i.e. subsequent working including a previous error is credited, if otherwise correct.							
	Inc N/k	orrect (g) an	t units, errors in powers of 10 (except where the po d unit multipliers are to be treated as arithmetical erro	ower of 10 come rs.	s from g	= 10			
	Co wh	rrect en the	numerical answers with incorrect units will normally working is not shown.	gain preceding	C marks	even			
	Do	not p	enalise a sig. fig. fraction or a unit error more than one	ce in the same qu	uestion.				
Sig. Fig	J. An An up	swers swers or do	must given to 2 or more sig. fig. except where the an given to 2 or 3 sig. fig. must be correctly rounded – b wn.	swer is exactly 0. ut a 5 can produc	.6, 2 etc. ce a round	ding			