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Mark Scheme (Results)

Summer 2013

GCSE Physics (5PH1H)
Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.

- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.

- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).

- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.

- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear

- Select and use a form and style of writing appropriate to purpose and to complex subject matter

- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	cosmic microwave background (radiation) all three words needed		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	(the) Big Bang (theory)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	change in the (observed) frequency **or** wavelength of light/radiation (received from a distant galaxy)	light/absorption lines is/are shifted toward red end of spectrum light/radiation has longer wavelength/lower frequency waves are more spread out/stretched Ignore references to sound or colour of light eg galaxies/light appear(s) red(er)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iv)	An explanation linking the following:- It/the Universe is expanding (1) some galaxies are (moving)faster (than others) (1)	they/ galaxies are moving further/away (from the Earth/us) the further away the galaxy is the greater the red-shift/the faster the galaxy is moving (some galaxies) are moving away faster (than others) gains 2 marks IGNORE references to planets/stars	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	D red giant then white dwarf		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	an explanation linking **two** of the following: • Different/more wave(length)s/frequencies (now) detected/collected (1) • because telescopes positioned above Earth's atmosphere or by radio telescopes (1) OR • weaker signal(s) (now) detected/collected (1) • because modern telescopes are more powerful/have greater magnification **or** positioned above Earth's atmosphere/ on top of mountains (1) If no other marks awarded allow 1 mark for idea that: Electronic(s)/computers can process/improve the data/signal information/waves/radiation	named type of em radiation accept CMB for microwave space telescope or named space telescope (because) less or no light/radiation is absorbed by Earth's atmosphere Accept named space telescope eg Hubble/Planck/Compton etc Ignore references to clearer images/more detail/can see further/photographs	**(2)**

PMT

Questio n Number	Answer	Acceptable answers	Mark
2(a)(i)	An explanation linking • 60 % of {total/electrical/input/output} energy (is used/transferred) (1) • into/is kinetic/useful energy (1) If no other marks scored accept: 60% (of the energy produced by the motor) is useful/40% is wasted for 1 mark	**Accept reverse argument ie** 40 % of {total/electrical/input/output} energy (is/transferred) into/lost as/thermal (heat)/waste energy	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	☒ **B** energy		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	substitution 20 x 15 (1) evaluation 300 (J) (1) If no other mark scored award 1 mark for correct transposition ie E= P x t Ignore any unit given by candidate	Power of 10 error maximum of 1 mark eg 300 000 (J) gains 1 mark Give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iv)	substitution 18 ÷ 24 (x 100) (1) evaluation 0.75 or 75% (1) Ignore any unit given by candidate	Power of 10 error maximum of 1 mark give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	☒ **B** conservation of energy		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	☒ D ROS		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	☒ C changes changes		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	An explanation linking **three** of the following: • the (objective) lens (1) • collects light (from Jupiter) (1) • focuses/converges/refracts the light (1) • (objective) produces a real image (1) • (at the) focal point (1) • (Image is viewed by the) eyepiece lens (1) • (Eyepiece) produces a virtual image (1)	Marks can be awarded for a labelled diagram	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	An explanation linking the following: (the geocentric model) • has the Earth at the centre of the Universe/solar system / everything orbits the Earth (1) (but Galileo observed) • moons of Jupiter (1) • (so) not all things orbit the Earth/ geocentric model is wrong (1)	**Accept alternative argument:** Galileo observed moons/stars/objects Orbiting/going round Jupiter (this) suggested that not everything orbits the Earth	**(3)**

Question Number	Answer	Acceptable answers	Mark

3(c)	2100/500 = 4.2 (1)
	
	4.2 x 150 = 630 (million km) (1)
	
	Accept ratios as speed is constant
	
	150/500 = distance to Jupiter/2100
	OR
	Distance to Jupiter = (150/500) x 2100
	Either for 1 mark
		Power of 10 error maximum of 1 mark
		
		(speed of light) about 150 000 000 ÷ 500 = 300 000 (km/s) (1)
		
		(distance to Jupiter)= 300 000 x 2 100
		           = 630 000 000 <u>km</u> (1)
		           / = 630 (million km)
		
		 An answer with no calculation of 630 (million km) gains 2 marks
		If an answer of 630 million/ 630 000 000 is given with correct working award both marks
			(2)

Question Number	Answer	Acceptable answers	Mark
4(a)	☒ **D** both transverse and longitudinal waves		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	A description including **three** of the following points • molten rock/magma (in mantle) (1) • convection currents (in mantle) (1) • plates move (1) • build up of pressure/force/energy (when plates (not) sliding over/under/past (each other)) (1) • sudden movement when pressure becomes too great/is released (1) • This sudden movement of plates is an earthquake (1)	Marks can be awarded on a labelled diagram Description of convection currents or arrows on diagram plates rub together Jolt/jerk when pressure becomes too great/ is released	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)	relevant values 110 and 10 seen anywhere(1) 100 (s) (1) **acceptable range 95 to 105** (s)	(could be on chart) tolerance +/- 5 s give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	any vertical line of 10 squares on graph between P- wave and S- wave (1) OR times eg 52 (s) – 32(s) Range (48 to 56) – (29 to 35) 220 (km) (1)	Range 9 to 11 squares range 200 to 240 (km) give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(e)	a description including **two** of the following: • longitudinal / sound (wave) (1) • (frequency) less than <u>20 Hz</u> (1)	<u>Frequency</u> below range/too low for (normal) human ear	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	Gamma/ γ (wave(s)/ ray(s)/radiation)	X-rays/ radiation	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	Any two from It fluoresces　　(1) UV (radiation) transfers/gives energy to ink/ink absorbs energy from UV (radiation)　　(1) (energy from UV is)(re-)radiated/(re)- emitted by ink at lower frequency/as (visible) light　　(1)	fluorescent Ink/it absorbs UV (light/radiation) Ignore UV is reflected as visible light Ignore luminous emits visible light	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	transposition $\lambda = v/f$　　　　(1) substitution $\lambda = 3 \times 10^8/7 \times 10^9$　　(1) evaluation 0.043　(m)　　　　(1) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. $3 \times 10^8/7 \times 10^9$　　gains 2 marks Accept any number of sig.figs. that rounds to 0.04 0.04 , 0.0428　(m)　　(1) Give full marks for correct answer with no working. 0.04 x any other power of 10 = 2 marks	**(3)**

Question Number		Indicative Content	Mark
QWC	***5c**	A discussion including some of the following points Possible dangerous e-m radiations Microwaves Infrared Ultraviolet (UV) X-rays gamma rays Correctly linked to Internal heating of body cells (microwaves) Skin burns (infrared) Damages skin cells/sunburn (UV) Damages eyes (UV) Can cause skin cancer (UV) Can cause cataracts (UV) Damage to cells inside the body(X-rays) Mutate/ kill cells in the body (gamma) Damages DNA (X-rays and gamma rays) Link to frequency As the frequency increases/wavelength decreases (microwave -> gamma) the waves become more penetrating and do more damage/danger as they have more energy.	**(6)**
Leve l	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. gives at least 2 correct radiations and links both to correct damage OR at least 2 correct radiations named with link to correct damage from one and idea that frequency is linked to damage OR just has link between higher frequency and more damage/dangerous e.g. infrared burns your skin and X-rays can damage cells. OR X-rays have a higher frequency than microwaves and can cause cancer OR Higher frequencies cause more damage to cells. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. gives most of the correct radiations and links to correct damage, at least one with detail of the damage that is caused OR links two to detail of the damage, AND has a link between frequency and energy/danger e.g. Microwaves are absorbed by water in body cells. UV can cause skin cancer and damages your eyes. X-rays and gamma rays can damage cells inside your body OR Gamma and X-rays can penetrate deep into the body. Gamma does most damage as it has the highest frequency. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. gives most of the correct radiations with links to detail of the damage AND explains the link between frequency	

		and energy/danger. e.g Microwaves heat up the water in cells. UV can cause cataracts. Gamma rays are the most penetrating and can mutate cells inside the body because they have the highest frequency. • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
6(a)	transformer	Step-up transformer Step-down transformer	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	A suggestion to include any 2 of the following • (LED) turns on and off • as voltage/current {changes direction/from +ve to –ve/ twice each second } (1) • (LED) on for (+ve) part of cycle (1) • (LED) off for (-ve) part of cycle (1)	Flash(es) / flicker(s) (on and off) current changes every 0.25 s /4 times each second Turns on twice each second = 2 marks Only on when voltage/current is +ve gains both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	substitute (1) 3 = I x 12 transformation (1) I = 3 ÷ 12 evaluation (1) 0 .25 (A) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. Accept any number of sig. figs. that rounds to 0.25 (A) 250 <u>m</u>A gains 3 marks give full marks for correct answer, no working 2.5 x any other power of ten = 2 marks eg 25 (A) gains 2 marks	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A discussion including some of the following points • improved lighting levels for LEDs • energy savings per year for LEDs or calculation of payback time • calculation of energy savings over lifetime of LEDs or calculation of monetary savings by using LEDs per year • link to savings in fossil fuels for LEDs or link to reduced CO_2 produced for LEDs and reduced global warming • comparison of lifetimes and maintenance cost	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited discussion of benefits using some pieces of the information provided, e.g. LEDs last 40 000 hours longer and the lighting levels are 200% brighter. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple discussion of benefits using some pieces of the information and processing one of them OR 2 processed pieces of information. e.g. LEDs save 3000 kW h of energy each year and are much brighter. The money they save each year compared to fluorescents is £420. OR The payback time for the LEDs is about 5 years and in that time they would have to pay for the fluorescent lights to be replaced 5 times. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed discussion of benefits using processed information covering more than half of the data points in the table e.g. LEDs use less energy each year and this means that fossil fuel reserves are not used up as quickly. The LEDs save £420 each year and have a payback time of about 5 years. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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