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Mark Scheme (Results)

Summer 2013

GCSE Physics (5PH3H)
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)	⊠ **C** (graph C)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	A description including: • collisions (1) • with (walls of) cylinder (1)	hit / bounce off exert force	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	substitution (1) either 100 × V = 15.0 × 21 000 or V = $\frac{15.0 \times 21\ 000}{100}$ evaluation (1) 3 150(litres)	$V_1P_1 = 15 \times 21000 = 315000$ (1 mark) $V_2P_2 = \mathbf{100} \times 3200 = 320000$ (1 mark) award full marks for 3150 (litres) without working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	substitution (1) $\frac{21\ 000\ (\times\ V)}{305} = \frac{P\ (\times\ V)}{278}$ volume same (1) evaluation (1) 19 100 (kPa)	give full marks for correct answer, no working transposition accept 19141 (kPa) or 19000 and numbers rounding down to 191 00	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	☒ **B** highest frequency		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	☒ **D** positively charged		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	an explanation linking: • (when) the filament is {heated/very hot} (1) with **one** of: • electrons escape (have enough energy) (1) • electrons escape from the surface (1)	cathode / metal (for filament) released accept boil off IGNORE produces / emits	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iv)	a suggestion that electrons do not reach target	otherwise electrons collide with (air) particles electrons are absorbed electrons ionise air stops electrons reaching target	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	transposition 2 x e x V/ m = v^2 (1) substitution v^2 = 2 x 1.6 x 10^{-19} x 40 000/9.1 $x10^{-31}$ (1) evaluation of v 1.2 x 10^8 (m/s) (1)	 Either order ignore powers of ten until evaluation give full marks for correct answer, no working accept 1.19 $\times 10^8$	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	☒ **A** electron		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	suggestion to include **two** of • the ionisation is different (1) • correct difference in ionisation (1) • the <u>masses</u> are different (1) • alpha is bigger than beta (1) • alpha hits more (air) particles (1) • alpha loses its energy in shorter distance (1)	alpha more ionising (than beta) scores 2 marks RA (heavier for bigger) RA RA IGNORE references to penetration	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)	☒ **A** gamma radiation		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	A description linking the following: • neutron decays / changes / becomes (1) • (neutron) into proton (1) • (plus an) electron (1)	quark changes (quark changes) from down to up / d to u e^- (do not accept β^-) accept n and p for neutron and proton n > p + e^- scores 3 marks IGNORE references to atomic and mass numbers; unstable nuclei; too many neutrons; gamma emitted	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	An explanation linking **three** of the following: • mass number doesn't change (1) • (because) same number of nucleons / quarks (1) • atomic number goes up by one (1) • (because) there is an extra proton (1)	 emitted electron mass is negligible proton and neutron have same mass a neutron has (decayed in)to a proton	 **(3)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	momentum = 0.03 × 170 (1)	Accept 5.1 seen	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	momentum before = momentum after (1) 5.1 = 0.83 × v (1) v = 6.1 (m/s) (1)	allow 5.0 = 0.80 x v for 1 mark max 5.0 = 0.83 x v v = 6.0 (m/s) allow ecf from (a)(i) give full marks for correct answer, no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	Statement to include any two from • kinetic energy is not conserved (1) • (lost ke) appears as heat/sound (1) • momentum is conserved (1)	ke not conserved / some ke lost no momentum lost	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	an explanation linking • momentum (must be) conserved (1) • so must have positive and negative momentum (1)	photons move in opposite directions indication of movement in opposite directions (e.g. opposite velocities)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	E = (2 ×) 9.1 × 10^{-31} × [3 × 10^8]^2 (1) = 1.6 × 10^{-13} (J) (1)	8.2 × 10^{-14} (0.82 × 10^{-13}) for 1 mark give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	☒ **B** 2.5 ÷ 4		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	either P = 2.5 x 0.2 or 2.5 = P / 0.2 (1) 0.5 (W)　　　　　　(1)	give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	3.0 +/- 0.5 (cm)		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	an explanation linking • 2 MHz (1) and any **one** from: • has a higher intensity inside tissue　(1) • less energy absorbed (1) • less attenuation (1) • penetrates furthest /deepest　(1)	this frequency alone RA loses intensity more gradually highest penetration accept "2MHz and 4MHz" with correct reason for 1 mark	**(2)**

Question Number		Indicative Content	Mark

QWC	***5(c)**	A comparison of endoscopes with any one of the following devices:
		 Diagnostic devices
		     • CAT scanners
		     • Fluoroscopes
		     • Thermal imagers / IR thermometers
		     • Pulse oximeters
		     • PET scanners
		     • X-ray machines
		     • Gamma cameras
		
		 Link to electromagnetic radiation
		     • Endoscopes use TIR of light in optical fibres
		     • CAT scanners X- rays and computer to generate 3D images
		     • Fluoroscopes use X- rays and a video camera
		     • Thermal imagers use infrared emitted by a body
		     • IR / red LEDs used to measure oxygen levels
		     • PET scanners detect radiation emitted by electron-positron annihilation
		     • Gamma cameras detect gamma rays from radioactive sources
		
		 Other factors for comparison
		     • Safety
		     • Ease of use
		     • Frequency / wave length
		     • Intensity
		     • Penetration
		     • Ionising / non-ionising
			(6)

Level	**0**	No rewardable content	
1	**1 - 2**	• a limited comparison between an endoscope and one device e.g. endoscopes use light and CAT scanners detect broken bones • 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 comparison between an endoscope and one device, linking them to the electromagnetic radiation used for both and a detail of use for one of them e.g. endoscopes use visible light to examine internal organs and CAT scans use X-rays • 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 comparison between an endoscope and one device, linking them to the electromagnetic radiation used for both and a detail of use for both of them e.g. endoscopes use visible light which is passed down optical fibres by TIR to examine internal organs. Fluoroscopes use X-rays and a video camera to show positioning of stents in arteries. • 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)(i)	iris	allow any recognisable spelling	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	In either order • cornea (1) • lens (1)	aqueous humour vitreous humour allow any recognisable spelling	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)	substitution (1) 1/f = 1/47 + 1/20 transposition **or** evaluation of 1/f (1) 0.071 evaluation of f (1) 14 (cm)	$f = \dfrac{1}{(1/47 + 1/20)}$ scores 2 marks numbers that round down to 14 give full marks for the correct answer, no working	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	An explanation including some of the following points • normal eye image forms on retina • for all distances of objects • short sight • (clear) image of a distant object forms inside the eye / in front of retina • corrected using diverging lens • diverging the light / makes image distance longer • long sight • (clear) image of near object forms "beyond" the retina • corrected using converging lens • converging the light / makes image distance smaller Other methods of correction include • contact lenses which change the curvature of the cornea • laser correction changes curvature of cornea	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation of both long and short sight **OR** either long or short sight and how it is corrected eg long-sighted people cannot see near objects and this can be corrected by convex lenses • 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 explanation of both long and short sight **AND** either how one is corrected or detail of image formation eg, long-sighted people cannot see near objects but short sighted people cannot see distant objects because the image forms in front of retina. • 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 explanation including both long and short sight **AND** how one is corrected **AND** detail of image formation eg long – eyeball too short so image of nearby object is beyond the retina, short-sighted people cannot see distant objects, which can be corrected by concave lenses • 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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