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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Physics (5PH3F) Paper 01
Unit: Applications of Physics

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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.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1 (a) (i)	A protons B neutrons C electrons	OR A neutrons B protons C electrons	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(a) (ii)	**12**		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	**B** It is very ionising		**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (c)	gamma (1) beta (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	**A decreases by 2** **decreases by 4**		**(1)**

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	solid liquid	in either order plasma as an alternative to either.	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	**C** temperature of the gas measured in Kelvin		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	an explanation **linking** two of the following three points:- particles move (1) bombarding/colliding (1) with wall/side (1) (only give if one of the previous marks is there) (of container)	 molecules/they move hit ignore 'pushing' e.g. molecules push on walls = 0 bounce off inside of container =2	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	substitution $P_2 = \frac{101\ 000 \times 340}{2.5}$ (1) Evaluation 13.7 to any power of 10 (1) 13 700 000(Pa), 13 700kPa (1)	 1.37(36) X 10^7/ 13736000 14 to any power of 10 14 000 000 (Pa), 14 000 (kPa) Full marks are awarded for the correct answer with no working	**(3)**

Total for Question 2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
3(a i)	Description including • the use • further detail	 e.g. security in airports / treat cancers e.g. to detect illegal items etc./ by killing cancer cells / they are ionising radiation 'to kill tumours' by itself = 1 mark 'to see broken bones' = 1 mark (crediting **different** detail compared to CAT scans) ignore scanning for tumours	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(aii)	UPPER label → X-ray tube (not just 'emitter' by itself) **(1)** LOWER label → detector(s) **(1)**	accept source / emitter or equivalent as alternative to tube. accept sensor(s) / photomultiplier(s) / receiver / camera	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)	An explanation linking two of the following • heated (1) • filament / wire (1) • any correct reference to potential (difference). (1) • vacuum (1)	 cathode at a negative voltage / (electrons attracted to) anode at positive voltage (accept charge as alternative to voltage) alternative: thermionic emission (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	**D** lead		**(1)**

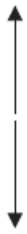
Question Number	Answer	Acceptable answers	Mark
3(c) (ii)	A description to include • as thickness increases the radiation getting through decreases (1) • uses data from the graph quantitatively (1) • reference to curve/non-linear (1)	 accept negative correlation (ignore inverse proportion) one mark for using **two** sets of data to show reduction levels off allow three marks for using at least two sets of data to apply the halving idea ignore phrases not describing the relationship e.g. 'it slowly decreases'.	**(3)**

Total for Question 3 = 10 marks

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	**B** magnetic		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	(high frequency alternating) voltage	electric field / electrostatic force electrodes + and − (not just 'electrodes') potential difference (p.d.)	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	A description using the following:- (charged) particles bombard (1) atoms/molecules/nuclei / (stable) elements (1)	(charged) particles {hit / shoot into / fired into / collide with} generally accept 'it' / 'they' as alternatives to 'charged particles' target (material) / nucleus / **<u>stable</u>** isotope 'neutrons hitting a target' would get second mark only (neutrons not charged) 2nd mark needs idea of hitting target nuclei / atoms, not (charged) particles hitting other particles.	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	**C** 		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	An explanation linking any three of the following:- positron has a positive (charge) (1) electron has a {negative (charge) / opposite charge(s) } (1) these charges cancel out (1) gamma rays /waves have no charge (1)	 positron has +1 / +e (charge) positron charge is + electron has -1 / -e (charge) electron charge is − neutralise / overall charge is zero Accept for three marks: electron and positron have equal and opposite charges which cancel out.	**(3)**

Question Number	Answer	Acceptable answers	Mark
4 (b)(iii)	An explanation linking : positron and electron have mass(before the annihilation) (1) gamma (rays produced by annihilation) have energy (1) (the equation shows)	 mass (of particles) becomes energy of gamma (rays) (2) all the mass before the collision becomes the energy of the gamma (rays) after the particles have been annihilated (2) $E=mc^2$ reference (1) explained will get the other (1)	**(2)**

Total for Question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	**C** total internal reflection		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	drawn ray changing direction at the boundary as it goes into the glass (1) towards the normal after entering the glass (1)	line should be near to straight allow dotted lines / don't need arrows ignore lines outside the glass block **reject** lines in the block going to the left of the normal.	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)(i)	each point plotted to within half a small square.	i.e. first plotted point to lie within 22→24, second 30→32 must be plotted; can't assume under any line they draw	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)(ii)	one best fit **curved** line close to / through most of points	**the best fit line does not have to extend beyond the plotted points.** reject very shaky / point to point drawing and tramlining (multiple lines). Reject lines forced through the origin involving kinks / changing directions in order to do so.	**(1)**

Question Number		Indicative Content	Mark
QWC	**5c (iii)**	An explanation including some of the following ideas :- • idea(s) of refraction / reflection / TIR conveyed • as angle of incidence increases so angle of refraction increases • becomes increasingly steep/ gradient increases (non-linear) • because of refraction (light speeding up) • at 42° light stops refracting / up to 42° limit idea • critical angle case described in terms of an emerging ray along the boundary (or similar) • beyond 42° reflection occurs • this is total internal reflection • then angle of incidence = angle of reflection (in the glass)	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation including isolated facts e.g. about light bending / refraction • 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 linking facts about a part of the process e.g. as angle of incidence increases so angle of refraction increases • 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 which links ideas about more than one part of the whole process e.g. an accurate explanation of refraction before 42° and TIR after 42° • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)	**A** gamma		**(1)**

Question Number	Answer	Acceptable answers	Mark
6 (b)	An explanation linking the following:- (it is) ionising (1) (can cause) damage to tissue/ mutation/cancer/tumours (1)	 has high frequency/energy kill cells / (causes) burns	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	Any three from: • keep distant from sources / (stand) in a separate room (behind leaded window etc.) • limit **time** exposed to the radioactivity • use lead shielding for the sources / handle sources with tongs etc. / dispose radioactive material(s) safely • wear lead aprons / used lead-lined clothing / lead-lined gloves • monitor exposure with some detector / badge / use of (radiation) meters	 (distance also involved if you) use computer controlled equipment the time aspect must be clear here. ignore goggles / (special) gloves without detail. Similarly ignore 'radiation resistant' (clothes)	**(3)**

Question Number		Indicative Content	Mark
QWC	**6(d)**	A description including some of the following points :- Diagnosis • radioactive tracers used in the body • to check systems e.g. skeleton / bone, blood flow, thyroid activity, kidney function. • attached to some compound which targets a particular area of the body • radioactive tracers are isotopes with short half-lives put into the body • may go into PET scans, since this involves beta+ emitters • gamma cameras, used to detect emissions from radioactive tracers Treatment • radiotherapy, use of gamma rays (from cobalt 60) / gamma rays aimed at a tumour to destroy cancerous cells. (Use of multiple beams) May cause damage to normal cells. • radioactive inserts placed into the body to destroy cancerous cells, mainly used for prostate cancer. ignore chemotherapy, ultrasound scans, endoscopes etc.	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited description of one procedure used for either diagnosis **OR** treatment e.g. idea of tracers or an elementary notion of radiotherapy given • 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 of one procedure used for either diagnosis **OR** treatment e.g. the tracer emits gamma rays which are detected using a gamma camera showing up area of high uptake / radioactivity; uses radioactive sources emitting beta / gamma radiation to destroy cancer cells. • 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 a procedure used for diagnosis and a procedure used for treatment. e.g. a short-lived radioactive tracer is injected into the body which then shows up areas of high activity via a gamma camera **AND** radiotherapy uses gamma to destroy cancer cells in a targeted way, with some detail. PET scanning details acceptable on the diagnosis side. (N.B. The diagnosis aspect may be covered in more detail than the treatment or vice-versa) • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 6 = 12 marks

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