edexcel

Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE in Physics (5PH3H) Paper 01
Unit P3: Applications of Physics

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2016
Publications Code 5PH3H_01_1606_MS

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	Notes	Marks
1 (a)	**C** no external forces act		(1)

Question number	Answer	Notes	Marks
1 (b) (i)	Substitution (1) Momentum before = 0.21 X 0.47 Evaluation (1) = 0.099	This is a 'show that' so must see working accept 0.0987 or 0.09 9.87 x 10^{-2} Do not allow spurious conjuring with numbers to arrive at 0.10	(2)

Question number	Answer	Notes	Marks
1 (b) (ii)	substitution (1) 0.1 = 0.42 x v transposition (1) 0.10/0.42 Evaluation (1) 0.24 (m/s)	accept 0.099 = 0.42 x v If 0.21 kg used then max 2 marks (gives 0.476 m/s) Transposition and substitution can be in any order Accept 0.235, 0.236 and 0.238 Full marks are awarded for the correct numerical answer with no working	(3)

Question number	Answer	Notes	Marks
1 (b) (iii)	• It's inelastic (1) • **<u>Kinetic</u>** energy has been lost / **<u>KE</u>** not conserved / **<u>KE</u>** transferred to other forms of energy (1)	decreases	(2)

Question number	Answer	Notes	Marks
2 (a)	**D** + 3.2×10^{-19} C (1)		(1)

Question number	Answer	Notes	Marks
2 (b) (i)	An explanation linking **any** two of the following. • (they) lose energy (quickly) / slow down (1) (because they) • are highly ionising (1) • have (many) **<u>collisions</u>** (with other atoms) (1) • are massive particles (1)	Ignore less penetrating Do not allow 'ionising' without correct qualification Allow heavy / large(r) Accept big(ger)	(2)

Question number	Answer	Notes	Marks
2 (b) (ii)	Beta particles are less ionising (1)	Accept beta particles are travelling a lot faster / have less mass /lighter / smaller Accept less collisions Ignore more penetrating	(1)

Question number	Answer	Notes	Marks
2 (b) (iii)	substitution (1) $8.1 \times 10^{-13} = \frac{1}{2} \times 6.6 \times 10^{-27} \times v^2$ transposition (1) $(v^2) = \dfrac{2 \times 8.1 \times 10^{-13}}{6.6 \times 10^{-27}}$ $(= 2.5 \times 10^{14})$ evaluation (1) $v = 1.6 \times 10^7$ (m/s)	Substitution and transposition in any order (2.45×10^{14}) Full marks are awarded for the correct numerical answer with no working $(1.57 \times 10^7$ (m/s)) (no sf penalty) Any power of ten mistake would lose one mark in the process Use of $E = mc^2$ or mv^2 no marks (not K.E.)	(3)

Question number	Answer	Notes	Marks
2 (b) (iv)	speed / velocity of light / 3×10^8 (m/s)	Allow 3×10^8 with no units but reject when with wrong unit	(1)

Question number	Answer	Notes	Marks
3 (a) (i) (ii)	Plot the points: • 0.055, 156 (1) • 0.042, 119 (1) Best fit straight line drawn (1)	Allow within one square tolerance (±1 square) Allowed with no extra points plotted; does not need to be extended to origin	(3)

Question number	Answer	Notes	Marks
3 (a) (iii)	A description including: • As pressure increases 1/V increases Alternatively P and 1/V are positively correlated(1) • Goes up in equal steps/ constant increase / steady rate etc. (1) DO NOT ALLOW 'they are proportional' since the question asks for the relationship shown by the graph	Alternatively as pressure increases Volume (V) decreases **Pressure and 1/V** are proportional gets 2 by itself (subsumes MP1). Allow they (P and V) are 'inversely proportional' for 2 marks Do not allow 'positive correlation' by itself	(1) (1)

Question number	Answer	Notes	Marks
3 (b) (i)	283 (K) (1)		(1)

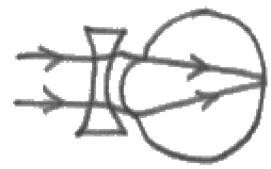
Question number	Answer	Notes	Marks
3 (b) (ii)	• transposition $V_2 = \frac{p_1 V_1 T_2}{P_2 T_1}$ (1) • substitution $V_2 = \frac{98 \times 100 \times 277}{78 \times 283}$ (1) • evaluation = 123 (m^3) (1)	transposition and substitution can be given in either order Accept 120, ignore sf Correct answer without working gets all 3 marks. if °C is used or there is a wrong conversion to K, one mark max (both in °C gives 50 m^3, both subtracting 273 gives 128.5)	(3)

Question number	Answer	Notes	Marks
3 (b) (iii)	**B** decreases		(1)

Question number	Answer	Notes	Marks
4 (a)	An explanation including any two of the following. • light/it changes speed/velocity (1) • correct change in speed (1) • wavelength gets smaller (1) • from lower refractive index to higher refractive index OR from lower <u>optical density</u> to higher <u>optical density</u> (1)	light travels slower (in glass / water compared to air) 2 marks Any reference to density must be qualified as **optical** density	(2)

Question number	Answer	Notes	Marks
4 (b)	**B** lens and cornea		(1)

Question number	Answer	Notes	Marks
4 (c) (i)	myopia/short sight/short sightedness (1)	do not accept near sightedness	(1)

Question number	Answer	Notes	Marks
4 (c) (ii)	An explanation linking two points. • a concave / diverging lens (placed in front of the eye) (1) • diverges the light / focuses the image further back / on the retina (1)	accept correct lens on diagram by itself for one mark e.g.  accept spreads light out for diverges accept increases the focal length Do not allow contradiction of wrong lens choice followed by diverges i.e. 2nd mark linked to first	(2)

Question number	Answer	Notes	Marks
4 (c) (iii)	• cornea (1) **and** one from • reshaped (1) • (curvature adjusted to form) image on retina (1)	Reject other parts of eye e.g. lens 2nd mark dependent on first ignore thinner	(2)

Question number	Answer	Notes	Marks
4 (c) (iv)	substitution (1) $\frac{40 \times 10^{-3}}{1.8 \times 10^{-6}}$ evaluation (1) 22000 (W m $^{-2}$)	 22 x 10^{3} (W m $^{-2}$) (2.2 x 10^{4}) 22222 W m $^{-2}$ Power of ten error, e.g. 2.2 x 10^{7} max 1 mark Correct answer without working gets 2 marks	(2)

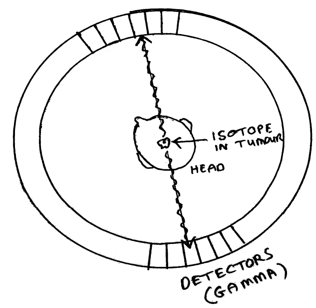
Question number	Answer	Notes	Marks
5 (a) (i)	**A** annihilation		(1)

Question number	Answer	Notes	Marks
5 (a) (ii)	**D** radioactive isotopes		(1)

Question number	Answer	Notes	Marks
5 (b) (i)	It / mass is converted to energy (of gamma)	may quote Einstein $E = m c^2$ / correct equivalence idea	(1)

Question number	Answer	Notes	Marks
5 (b) (ii)	substitution (1) $9.1 \times 10^{-31} \times (3.0 \times 10^8)^2$ evaluation (1) 8.2×10^{-14} (J)	accept 8.19×10^{-14} (J)	(2)

Question number	Answer	Notes	Marks
5 (b) (iii)	idea that **isotopes** (used) have a short half-life (1)	accept 'they don't last very long' or words to that effect The focus needs to be on the time (not just convenience).	(1)

Question number	Answer	Marks
5 (c)	A description including some of the following points :- Step1 • radioisotope / fluorine -18 is beta + emitter (positron emitter) / attached to glucose • goes to site of tumour / radiation emitted from tumour site **Step 2** • patient lies inside scanner (detector array) • annihilations occur • (two) gammas are emitted • in opposite directions **Step 3** • gammas are detected (on opposite sides) • simultaneous detection used • idea of triangulation • image reconstructed by computer • brain tumours found by calculating positions of where the gamma rays were emitted from • credit labelled diagram such as:  	(6)

Level	0	No rewardable content
1	**1 - 2**	• a <u>limited</u> description of how PET scans are produced (**from one step of the process**) e.g. detecting gamma rays from (within) the patient OR describing how the images are formed in a limited way (use of (gamma) cameras). (Do not credit where the gamma rays seem to be coming from some source outside the body, as with an X-ray tube) • 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 <u>simple</u> description of how PET scans are produced, using isotopes which are beta+ emitters and detecting the gamma rays. (**linking any two steps of the process**) e.g. detecting gamma rays from (within) the patient AND describing how the images are formed in a limited way (use of (gamma) cameras). • 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 <u>detailed</u> description of how PET scans are produced involving appropriate isotopes and annihilations giving off gamma rays in opposite directions which are detected (by a gamma camera). (**linking all three steps of the process**) • 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	Notes	Marks
6 (a) (i)	Thermionic emission (1)	Ignore any spelling mistakes	(1)

Question number	Answer	Notes	Marks
6 (a) (ii)	An explanation linking any two of the following: **<u>Electrons:</u>** • will not collide with gas molecules / atoms / particles in air • will not slow down • will not lose energy • will reach the anode / target	No mention of electrons – zero marks Accept stops collisions (occurring) Do not accept 'react' maintain speed (enables) electrons to reach anode knock off course (change direction insufficient)	(2)

Question number	Answer	Notes	Marks
6 (a) (iii)	Substitution (I) = $3.0 \times 10^{17} \times 1.6 \times 10^{-19}$ (1) evaluation (1) I = 0.048 (A)	4.8×10^{-2} (A), 48mA Full marks are awarded for the correct numerical answer with no working Do not allow evaluation mark for 0.05A (with no working)	(2)

Question number	Answer	Notes	Marks
6 (a) (iv)	**C** I is inversely proportional to d^2 (1)		(1)

Question number	Answer	Marks
6 (b)	Uses, could include some of the following points • <u>CAT scans</u> can be used to detect tumour in brain / abdomen / blood vessels (around heart) • They are used because the tissues show up well (in detail) with this type of scan • (2-D) slices taken • to construct 3-D images • They may be associated with a higher radiation dose with consequences (e.g. avoid with pregnancy etc.) • They give a higher quality image (with uses) • May use dyes to show up blood vessels • <u>Fluoroscopes</u> used to give 2-D {moving / live /real} images / showing up the (relevant) tissues (May refer to contrast media e.g. barium meal etc.) / reveals function • Fluoroscopes used to enable medical personnel to see the flow of fluid through the gut / intestines / to accurately place devices inside the body / to look at blood vessels and organs	(6)

Level	**0**	No rewardable content
1	**1 - 2**	• a limited discussion to include either the uses of one type of scan e.g. a CAT scan is used to diagnose cancer in head OR fluoroscopes used for moving images • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 -**	• a simple discussion to include uses for both scans OR detailed use of one scan e.g. CAT scan is used to

	4	diagnose cancer in a named organ AND Fluoroscopes used for moving images OR CAT scan is used to detect tumours in particular parts of the body, showing up the tissues involved well • 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 to include both scans with at least one of them in detail e.g. CAT scan are used to detect tumours in particular parts of the body, showing up the tissues involved well AND fluoroscopes are for moving images. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London WC2R 0RL