Mark Scheme (Standardisation)

Summer 2017

Pearson Edexcel GCSE

In Physics (5PH3H) Paper 3H

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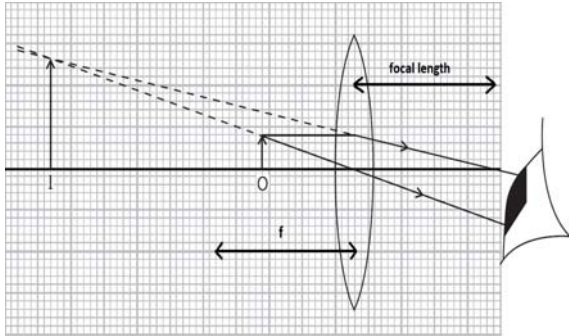
General Marking Guidance

- 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.

- 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.

Question number	Answer	Notes	Marks
1 (a)	unit conversion(1) 10 cm to 0.1 m substitution (1) power = 1 ÷ 0.10 evaluation (1) = 10 units (1) dioptres / D	 Allow unconverted value for substitution and evaluation marks: 1/10 (1 mark) = 0.1 (1 mark) separate unit mark ignore lower-case 'd' Allow small spelling errors (but not 'diodes' for example) 1/10 = 0.1 D gets 3 marks 10 D is a correct answer for 4 marks	 **(4)**

Question number	Answer	Notes	Marks
1 (b) (i)	 focal length as shown – judge length by eye	May label focal length as 'f' but must be labelled this may be shown to the right or to the left of the lens (~21 small squares) **Distance shown must be a horizontal distance.**	 **(1)**

Question number	Answer	Notes	Marks
1 (b) (ii)	any attempt to measure the image or object height (1) magnification = 3.3 ± 0.3 (1)	Accept similar triangle approach or using distances from lens An answer in this range scores 2	(2)

Question number	Answer	Notes	Marks
1 (b) (iii)	The image is virtual	Accept 'not real' / cannot be captured on a screen	(1)

Total for question 1= 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	☒ D increase the probability of causing mutation of DNA in cells **The only correct answer is D** **A** is not correct because radiation increases, not decreases, the probability of causing mutation of DNA in cells **B** is not correct because ionising radiation does not always cause burns; lesser damage than this occurs often **C** is not correct because radiation **may** cause the mutation of DNA in cells		**(1)**

Question Number	Answer	Acceptable answers / notes	Mark
2 (b)	Description including any three from: Increasing/safe **distance** from source (1)	Idea of being removed from the source, including being in a different room / use of tongs / handling equipment	
	wearing **lead**-(lined) apron / clothing (1)	ignore 'protective clothing' or 'shielding' (unqualified)	
	Specified shielding other than clothing (1)	Accept lead glass or concrete Ignore 'barrier' without qualification	
	minimising **time** spent using sources (1)		
	checking exposure using radiation badges / monitors (1)	Accept Geiger counters	
	use of <u>lead</u>-(lined) boxes (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking any three from: radioactive **source** next to tumour (1) alpha and/or beta (particles emitted) (1) ionising radiation (1) alpha has a low penetration / range (1) **(radiation)** mutate the DNA in (cancerous) cells (1)	Do not allow points if only referring to gamma radiation next to / in cancer alt. valid comment about beta range **(radiation)** damages/destroys/ kills / shrinks / the (tumour / cancer) cells stops it growing as long as not mentioned with gamma	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(d)	An explanation from one of the following alternatives: (A) gamma radiation/it is very penetrating (1) gamma radiation/it can be detected outside the body (1) OR (B) short half life (1) reducing radiation exposure time / danger(1) OR (C) long enough half life (hours) (1) to complete the investigation (in) (1) OR (D) gamma is not very ionising (1) so does not damage cells (1)		**(2)**

Total for question 2= 9 marks

Question number	Answer	Notes	Marks
3 (a) (i)	$\underline{144}$ A $\underline{60}$ one mark for each correct number		**(2)**
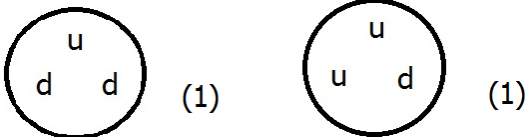
Question number	Answer	Notes	Marks
3 (a) (ii)	Plot the points: • 72, 108 (1) • 39, 50 (1)	Allow within one square tolerance	**(2)**

Question number	Answer	Notes	Marks
3 (a) (iii)	Best fit curve passing through / near to most points (1)	Reject any straight lines, shaky drawing point to point and tramlining (multiple curves) Make allowances for rubbing out pencil lines	**(1)**

Question number	Answer	Notes	Marks
3 (b)	emitters lie to the left / above the curve		**(1)**

Question number	Answer	Notes	Marks
3 (c)	⊠ **D** proton becoming a neutron and a positron **The only correct answer is D** **A** is not correct because that shows β ⁻decay **B** is not correct because then you would get 2 positive charges coming out of an original particle of 0 charge; not possible **C** is not correct because you can't have a negatively charged electron coming out of a positively charged proton like that		**(1)**

Question number	Answer	Notes	Marks
3 (d)	NEUTRON PROTON u d d (1) u u d (1)	u's and d's in any order within each circle	**(2)**

Total for question 3 = 9 marks

Question Number	Answer	Acceptable answers	Mark
4(a)	☒ B can move past each other **The only correct answer is B** **A** is not correct because that description applies to the gaseous state **C** is not correct because that description applies to a solid (crystalline) state **D** is not correct because particles are in continual movement in the liquid sate (Brownian motion)		(1)

Question Number	Answer	Acceptable answers / notes	Mark
4(b)(i)	Explanation including <u>particles</u> with: collide with walls / container (1) exert a force (1) pressure = force / area (1)	atoms / molecules / eq <u>no reference to particles (or alt.) no marks</u> hit, bombard, bounce off In the absence of any of these three marks award 1 for any reference to particles moving	(3)

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	An explanation including. (as) temperature rises particles move faster/ have more <u>kinetic</u> energy (1) hit the walls more frequently / harder (1)	(accept answer in terms of change of momentum) ignore 'move around more' accept more collisions / greater force	(2)

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	Adds 101 kPa to 5 x 101 kPa, giving <u>606</u> kPa = <u>6.06</u> x 10^5 Pa	Award the mark for 6.06 x 10^5 Pa seen anywhere by itself Beware of conjuring with numbers to come up with 6.06 x 10^5	(1)

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	 substitution (1) $6.06 \times 10^5 \times 1.25 \times 10^{-6} = V_2 \times 1.01 \times 10^5$ transformation (1) $\frac{6.06 \times 10^5 \times 1.25 \times 10^{-6}}{1.01 \times 10^5} = (V_2)$ Evaluation (1) $7.5(0) \times 10^{-6}$ (m^3)	transformation or substitution in either order Allow ecf from here for sensible value of pressure* $V_2 = \frac{P_1 \times V_1}{P_2}$ Using 6x10^5 (for pressure) gives 7.4(3)x10^{-6}(m^3) accept 7.42x10^{-6} also * Using p=5.05 x 10^5 => 6.25 x 10^{-6}(m^3) scores 2 marks power of ten error loses a mark correct answer by itself scores 3 marks	(3)

Total for question 4 = 10 marks

Question number	Answer	Notes	Marks
5 (a)	Any one from endoscope / looking into (named part of) body / keyhole surgery		(1)

Question number	Answer	Notes	Marks
5 (b) (i)	5.05 (W/m^2) (1)	Accept 5.0505	(1)

Question number	Answer	Notes	Marks
5 (b) (ii)		accept P = I X A	(3)
	Substitution (1) 5.0 =P ÷ 6.2 X 10^{-7}	transformation and substitution in either order	
	transformation (1) 5.0 X 6.2 X 10^{-7}	ignore powers of 10 until evaluation	
	Evaluation (1) = 3.1 x 10^{-6} (W)	(Allow use of any intensity between 4.95 and 5.05) full marks for the correct answer (which rounds to 3.1 x 10^{-6})	

Question number	Answer	Notes	Marks
5 (b) (iii)	⊠ **D** light scatters off impurity atoms at a wide range of angles **The only correct answer is D** **A** is not correct because that description describes light in a vacuum, not in a material **B** is not correct because whilst light does obey Snell's law this does not at all explain the decrease of intensity in a medium **C** is not correct because light does not get slower **as it travels through** the medium (it slows down as it moves from air into glass but the statement does not say that and that does not provide an explanation for intensity decrease, as asked for)		**(1)**

Question number		Answer	Marks

5 (c)		A description including some of the following points:
		USES to produce scans in diagnosis
		• a gel is applied to the abdomen
		• which allows the ultrasound to enter the body
		• where it reflects off organs (etc.)
		• is detected and used to make an image
		• shows organs up, including the heart, kidneys etc
		• used to examine unborn babies (foetuses)
		   may be used to diagnose kidney / heart problems etc
		   accept use in diagnosis for other soft tissue organs apart
		   from those in the unborn
		USES in treatment
		• used for shattering / breaking up kidney stones
		• by emitting pulses of ultrasound
		• which shatter the outer layers of the stones
		• the broken bits may be carried off (in urine)
		• accept treatments for sports injuries (ligaments, tendons etc.)
			(6)

Level	0	No rewardable content
1	1 - 2	• a limited description of how ultrasound works / what it is used for e.g. ultrasound waves enter the skin OR used to get rid of kidney stones • 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 how ultrasound is used in diagnosis and treatment OR a more detailed description of one of them e.g. ultrasound waves enter the skin and reflect off organs and used to break up kidney stones OR (for treatment) used for breaking up kidney stones as ultrasound vibrations (in pulses) can shatter the stones • 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 of how ultrasound is used in BOTH diagnosis and treatment e.g. used to examine unborn babies/foetuses using a gel applied to the abdomen allowing ultrasound to enter the body where it then reflects off internal organs and it is detected outside the body AND used for breaking up kidney stones as ultrasound vibrations (in pulses) can shatter the stones • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

SUMMARY, for guidance

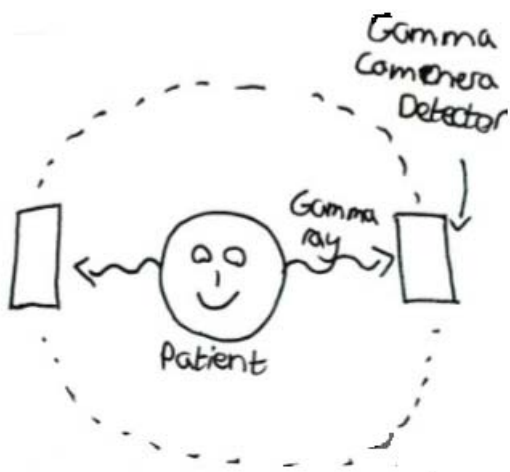| Level 1	Level 2	Level 3
Limited description Some diagnosis or some treatment	Simple descriptions SOME diagnosis AND SOME treatment OR a more detailed description of one of them	Discussion of both diagnosis and treatment with, for example, DETAILED descriptions in one area AND SOME descriptions in the other

Total for question 5= 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	☒ D force towards the centre of the circle due to a magnetic field **The only correct answer is D** **A** is not correct because the centripetal force is not directed **away** from the centre of the circle, and it is not a result of the electric field **B** is not correct the centripetal force is not directed **away** from the centre of the circle **C** is not correct because the force is not a result of the electric field		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a) (ii)	(alternating) **voltage** / potential difference (P.D.) (1)	Electric / electrostatic field (s) / use of electrodes Condone (allow) magnetic (field/ force) / magnets Ignore current but accept A.C. supply	**(1)**

Question Number	Answer	Notes	Mark
6(a)(iii)	(neutron) has no charge	Zero charge / only works with charged particles Ignore 'neutral (charge)'	**(1)**

Question Number	Answer	Acceptable answers / Notes	Mark
6(a) (iv)	Description including:	Accept atoms / particles /elements / isotopes for nuclei **throughout**	
	protons/they absorbed by nuclei (1)	Protons/<u>charged</u> particle/they collide with / hit / fired <u>into</u> nuclei	
		Do not accept electron	
		ignore 'fired at' / 'shot at' / 'bombarded'	
	of **stable** nuclei (1)		
	(to produce) **unstable** nuclei (1)		
		Protons colliding with protons gets 1 mark if no other mark awarded	**(3)**

Question Number		Indicative Content	Mark
QWC	***6 (b)**	An explanation including some of the following points :	
		Producing gamma rays	
		• electron-positron (B^+)annihilation produces gamma rays	
		• labelled diagram of electron-positron annihilation	
		• **two** gamma rays must be produced	
		• conservation of momentum	
		• conservation of charge	
		• conservation of mass-energy	
		• gamma rays produced in opposite directions	
		Detection of gamma rays producing an image	
		• the detectors are in a (non-rotating) ring around the patient	
		• gamma rays are detected by scintillation counters/gamma cameras	
		• gamma ray pairs are detected	
		• gamma rays that are not in pairs are ignored	
		• pairs of gamma rays that arrive at the same time are used	
		• the computer/system works out where the gamma rays came from (produces an image which shows the position of the tumour)	
		• triangulation	
		Credit picture e.g.	
			(6)

Level	0	No rewardable content
1	1 - 2	- a limited explanation of how the gamma rays are produced OR detected e.g. positrons collide with electrons, there is annihilation and gamma rays are produced OR gamma ray <u>pairs</u> are detected by a ring of gamma cameras around the patient - 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 how the gamma rays are produced and detected OR a more detailed explanation of one of these. e.g. when positrons collide with electrons there is annihilation and gamma rays are produced and gamma ray pairs are detected by a ring of gamma cameras around the patient OR, for production, when positrons collide with electrons there is annihilation and two gamma rays are produced OR, for detection, the computer detects pairs of gamma rays that arrive at the same time, producing an image - 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 of how the gamma rays are produced AND detected e.g B^+ particles are positrons, when positrons collide with electrons there is annihilation and gamma rays are produced. As momentum is conserved, the gamma rays travel in opposite directions. The gamma ray pairs are detected by a ring of gamma cameras around the patient. - the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately - spelling, punctuation and grammar are used with few errors

SUMMARY, for guidance

Level 1	Level 2	Level 3
Limited explanation → idea(s) re. production OR idea(s) re. detection	Simple explanations of production and detection OR more detailed explanations of either production or detection	Detailed explanations of production and detection

Total for question 6 =12 marks