Mark Scheme (Results)

Summer 2026

Pearson Edexcel International Advanced Subsidiary Level In Physics
WPH12/01A

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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.

Mark scheme notes

Underlying principle
The mark scheme will clearly indicate the concept that is being rewarded, backed up by examples. **It is not a set of model answers.**

1. Mark scheme format
1.1 You will not see 'wtte' (words to that effect). Alternative correct wording should be credited in every answer unless the MS has specified specific words that must be present. Such words will be indicated by underlining e.g. 'resonance'
1.2 Bold lower case will be used for emphasis e.g. '**and**' when two pieces of information are needed for 1 mark.
1.3 Round brackets ( ) indicate words that are not essential e.g. "(hence) distance is increased".
1.4 Square brackets [ ] indicate advice to examiners or examples e.g. [Do not accept gravity] [ecf].

2. Unit error penalties
2.1 A separate mark is not usually given for a unit but a missing or incorrect unit will normally mean that the final calculation mark will not be awarded.
2.2 This does not apply in 'show that' questions or in any other question where the units to be used have been given, for example in a spreadsheet.
2.3 The mark will not be awarded for the same missing or incorrect unit only once within one clip in epen.
2.4 Occasionally, it may be decided not to insist on a unit e.g the candidate may be calculating the gradient of a graph, resulting in a unit that is not one that should be known and is complex.
2.5 The mark scheme will indicate if no unit error is to be applied by placing brackets around the unit.

3. Significant figures
3.1 Use of too many significant figures in the theory questions will not prevent a mark being awarded if the answer given rounds to the answer in the MS.
3.2 Too few significant figures will mean that the final mark cannot be awarded in 'show that' questions where one more significant figure than the value in the question is needed for the candidate to demonstrate the validity of the given answer.
3.3 The use of one significant figure might be inappropriate in the context of the question e.g. reading a value off a graph. If this is the case, there will be a clear indication in the MS.
3.4 The use of $g = 10\ \text{m s}^{-2}$ or $10\ \text{N kg}^{-1}$ instead of $9.81\ \text{m s}^{-2}$ or $9.81\ \text{N kg}^{-1}$ will be penalised by one mark (but not more than once per clip). Accept $9.8\ \text{m s}^{-2}$ or $9.8\ \text{N kg}^{-1}$
3.5 In questions assessing practical skills, a specific number of significant figures will be required e.g. determining a constant from the gradient of a graph or in uncertainty calculations. The MS will clearly identify the number of significant figures required.

4. Calculations

4.1 **use of** the formula means that the candidate demonstrates substitution of physically correct values, although there may be conversion errors e.g. power of 10 error.

4.2 If a 'show that' question is worth 2 marks, then both marks will be available for a reverse working. If the question is worth 3 marks then only 2 marks will be available.

4.3 The mark scheme will show a correctly worked answer for illustration only.

5. Quality of Written Expression

5.1 Questions that asses the ability to show a coherent and logically structured answer are marked with an asterisk.

5.2 Marks are awarded for indicative content and for how the answer is structured.

5.3 Linkage between ideas, and fully-sustained reasoning is expected.

Question Number	Answer	Mark
1	**The only correct answer is D** wavelength A is not correct because the x axis is distance so can only give a wavelength B is not correct because the x axis is distance so can only give a wavelength C is not correct because the x axis is distance so can only give a wavelength	1
2	**The only correct answer is C** $f > \frac{3.8\times10^{-19}}{6.63\times10^{-34}}$ A is not correct as frequency must be more than or equal to $\frac{E}{h}$ B is not correct as frequency must be more than or equal to $\frac{E}{h}$ D is not correct as frequency must be more than or equal to $\frac{E}{h}$	1
3	**The only correct answer is B** $\mathrm{J\,\Omega^{-1}}$ A is not correct because $\mathrm{C\,s^{-1}}$ is an equivalent unit C is not correct because $\mathrm{V\,\Omega^{-1}}$ is an equivalent unit D is not correct because $\mathrm{W\,V^{-1}}$ is an equivalent unit	1
4	**The only correct answer is D** increase decrease A is not correct because the charge carrier density will increase and the drift velocity will decrease B is not correct because the charge carrier density will increase and the drift velocity will decrease C is not correct because the charge carrier density will increase and the drift velocity will decrease	1
5	**The only correct answer is A atomic line spectra** B is not correct because electron diffraction is explained by wave behaviour C is not correct because polarisation is explained by wave behaviour D is not correct because refraction is explained by wave behaviour	1
6	**The only correct answer is C** $\varepsilon = V_1 + V_2$ A is not correct as $\varepsilon = V_1 + V_2$ is the only correct relationship if the resistances are different B is not correct as $\varepsilon = V_1 + V_2$ is the only correct relationship if the resistances are different D is not correct as $\varepsilon = V_1 + V_2$ is the only correct relationship if the resistances are different	1
7	**The only correct answer is C decreased chance of interference** A is not correct because decreasing pulse duration leads to less interference B is not correct because decreasing pulse duration leads to less interference D is not correct because decreasing pulse duration leads to less interference	1
8	**The only correct answer is B 0.6 m** A is not correct as the next resonant frequency will be when the air column is 3 × 0.2 m = 0.6 m C is not correct as the next resonant frequency will be when the air column is 3 × 0.2 m = 0.6 m D is not correct as the next resonant frequency will be when the air column is 3 × 0.2 m = 0.6 m	1

9	**The only correct answer is D $4R$** A is not correct when the same mass of putty is rolled into a length 2l then the area must halve for the same volume. As $R \propto \frac{l}{A}$ the length is doubled and the area is halved so the resistance is four times larger B is not correct when the same mass of putty is rolled into a length 2l then the area must halve for the same volume. As $R \propto \frac{l}{A}$ the length is doubled and the area is halved so the resistance is four times larger C is not correct when the same mass of putty is rolled into a length 2l then the area must halve for the same volume. As $R \propto \frac{l}{A}$ the length is doubled and the area is halved so the resistance is four times larger	**1**
10	**The only correct answer is B**  A,C and D are not correct as this diagram shows the position of both pulses after 1 s. Superpose the displacements and the wave shape in B is produced. 	**1**

Question Number	Acceptable Answer	Additional Guidance	Mark
11	Polarised light has only one plane/direction (of vibration/oscillation) **Or** Filter only transmits one plane/direction (of vibration/oscillation) **(1)** Filter (axis) perpendicular to the (plane of polarisation of the) reflected/polarised light. **(1)** Filter absorbs (most of) the reflected/polarised light so Photograph A (was taken with the filter) **(1)**	Allow "blocks", "does not allow transmission", "stops" and similar for "absorbs"	**3**
	Total for question 11		**3**

Question Number	Acceptable Answer		Additional Guidance	Mark
12	Wavelength = 2 × 0.69 m (= 1.38 m)	**(1)**	Example of calculation $v = 220\ \text{Hz} \times 1.38\ \text{m} = 304\ \text{m s}^{-1}$ $\mu = \frac{1.17 \times 10^{-3}\ \text{kg}}{0.69\ \text{m}} = 1.70 \times 10^{-3}\ \text{kg m}^{-1}$ $T = (304)^2\ (\text{m s}^{-1})^2 \times 1.70 \times 10^{-3}\ \text{kg m}^{-1} = 157\ \text{N}$	**5**
	Use of $v = f\lambda$	**(1)**		
	Uses $\mu = \text{mass/length}$	**(1)**		
	Use of $v = \sqrt{\frac{T}{\mu}}$	**(1)**		
	Tension = 160 N, which is less than 200 N	**(1)**		
	Total for question 12			**5**

Question Number	Acceptable Answer	Additional Guidance	Mark
	13 (a) Calculate the frequency of the electromagnetic radiation.		
13(a)	Conversion of eV to J **(1)** Use of $E = hf$ **(1)** $f = 2.9 \times 10^{15}$ Hz **(1)**	Example of calculation $E = 12.1 \text{ eV} \times 1.6 \times 10^{-19} \text{ J/eV} = 1.936 \times 10^{-18} \text{ J}$ $f = \frac{1.936 \times 10^{-18} \text{ J}}{6.63 \times 10^{-34} \text{Js}} = 2.92 \times 10^{15}$ Hz	**3**
	13 (b) Explain what happens when this photon with an energy of 12.1 eV is absorbed by the atom of hydrogen.		
13(b)	The electron/atom is excited **Or** electron/atom moves up energy level **(1)** To the -1.5 eV level **(1)** Electron/atom will drop back down (to the ground level) **(1)** And emit a photon (of electromagnetic radiation) **(1)**	Allow both MP1 and MP2 if candidate states that electron/atom moves from ground level to -1.5eV Cannot award marks for descriptions of photons moving up and down levels	**4**
	Total for question 13		**7**

Question Number	Acceptable Answer		Additional Guidance	Mark
14(a)(i)	Use of $n_1 \sin\theta_1 = n_2 \sin\theta_2$ r = 44.7 (°) (minimum 3sf)	**(1)** **(1)**	Example of calculation $1.52 \times \sin r = 1.72 \times \sin 38.5°$ $r = \sin^{-1}\left(\frac{1.07}{1.52}\right) = 44.7^o$	**2**
14(a)(ii)	**EITHER** Use of $\sin C = 1/n$ C = 41.1° $i > C$, so TIR takes place **Or** $i > C$ so no refraction **OR** Use of $n_1 \sin\theta_1$ (= $n_2 \sin\theta_2$) $n_1 \sin\theta_1$ = 1.07 $\sin\theta_2 > 1$ so TIR takes place **Or** $\sin\theta_2 > 1$ so no refraction allow ecf from (i)	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	MP3 via either route is dependent on MP2 Example of calculation $\sin C = \frac{1}{1.52}$ C = 41.1°	**3**
14(b)	To reduce the angle of refraction (as light passes from LED to glass) **Or** To make the incident and refracted angles similar (as light passes from the LED layer to the glass) **(1)** This will lead to less/no reflection (at the glass-air boundary) **Or** So (more) light is transmitted/refracted out of the screen **(1)**		MP1 Do not credit "There is less refraction at the boundary between LED and glass"	**2**
	Total for question 14			**7**

Question Number	Acceptable Answer		Additional Guidance	Mark
15(a)	Use of $I = \frac{P}{A}$ to calculate intensity	**(1)**		
	Calculates a product intensity × resistance	**(1)**		
	Repeats and concludes these are not inversely proportional **Or** Repeats and concludes (that the website is) incorrect.	**(1)**	For MP3 both constants need to be calculated correctly <u>Example of calculation</u> $I = \frac{4.62 \times 10^{-7}\ \text{W}}{2.1 \times 10^{-5}\ \text{m}^2} = 0.022\ \text{W m}^{-2}$ $k = 0.022\ \text{W m}^{-2} \times 800\ \Omega = 17.6$ $k = 2.0 \times 10^{-5}\ \text{W m}^{-2} \times 500\ \text{k}\Omega = 10$	**3**

15(b)	**EITHER** In the dark, resistance of LDR is 500 kΩ (and the resistor is 125 kΩ) **(1)** Use of $V = IR$ to calculate circuit current in dark (8.0×10^{-6} A) **(1)** Use of $V = IR$ to calculate p.d. across resistor in dark **(1)** p.d. across resistor in the dark = 1.0V which meets specification **(1)** As light intensity increases, LDR resistance decreases **(1)** So p.d. across LDR decreases, p.d across the resistor increases which meets specification **Or (**Circuit) current increases, p.d. across the resistor increases which meets specification **(1)** **OR** In the dark, resistance of LDR is 500 kΩ (and the resistor is 125 kΩ) **(1)** Use of $V = IR$ to calculate circuit current in dark (8.0×10^{-6} A) **(1)** Use of $V = IR$ to calculate p.d. across resistor in dark **(1)** p.d. across resistor in the dark = 1.0V which meets specification **(1)** Repeats calculations for p.d. across resistor in the light **(1)** p.d. across resistor in the light = 4.97 V (which is greater than the p.d. in the dark) which meets specification **(1)**	**MP2 and MP3** can be awarded for use of the potential divider equation or equating resistance ratio with p.d. ratio **Alternative for MP1-4** V across the resistor is 1.0V used in calculation Use of $V = IR$ to calculate circuit current in dark (8.0×10^{-6} A) Use of $V = IR$ to calculate resistance of LDR in the dark R = 500000 Ω which meets specification Example of calculation Dark $V = \frac{125\ \text{k}\Omega}{(125+500)\ \text{k}\Omega} \times 5.0\ \text{V} = 1.0\ \text{V}$ Light $V = \frac{125000\ \Omega}{(125000+800)\Omega} \times 5.0\ \text{V} = 4.97\ \text{V}$	**6**
	Total for question 15		**9**

Question Number	Acceptable Answer	Additional Guidance	Mark
	16 (a) The light that is reflected by the glass block undergoes a change of phase. The change of phase is equal to a phase difference of 180°. Explain what is meant by 'a phase difference of 180°'. You may draw a diagram.		
16(a)	The displacement of the wave will change sign **Or** The waves are in antiphase **(1)** The waves have the same magnitude/amplitude **(1)**	Both marks can be awarded for a drawing showing waves with a phase difference of 180°	**2**
***16(b)**	**Indicative content** **IC1** Dark area related to destructive (interference) **IC2** Light area related to constructive (interference) **IC3** Destructive (interference) related to waves being in antiphase **IC4** Constructive (interference) related to waves being in phase **IC5** Dark areas have a path difference of $n\lambda$ (due to phase change of 180° on reflection) **Or** Central dark area has no path difference **IC6** Light areas have a path difference of $(n + ½)\ \lambda$ (Due to phase change of 180° on reflection)		**6**

This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning. Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning. The following table shows how the marks should be awarded for indicative content.

IC points	IC mark	Max linkage mark	Max final mark
6	4	2	6
5	3	2	5
4	3	1	4
3	2	1	3
2	2	0	2
1	1	0	1
0	0	0	0

The following table shows how the marks should be awarded for structure and lines of reasoning.

	Number of marks awarded for structure of answer and sustained line of reasoning
Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2
Answer is partially structured with some linkages and lines of reasoning	1
Answer has no linkages between points and is unstructured	0

	Total for question 16		**8**

Question Number	Acceptable Answer		Additional Guidance	Mark
17(a)	**EITHER** Use of $V = IR$ to determine p.d. across ammeter Use of p.d. is the same across parallel components Use of distribution of current is consequence of charge conservation I = 0.50 A **OR** Use of resistors in parallel formula Parallel resistance = 1.2(Ω) Use of $V = IR$ determine total circuit current I = 0.50 A	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	Example of calculation $V = 0.03\ \text{A} \times 20\ \Omega = 0.6\ \text{V}$ Current in 1.28 resistor $= \frac{0.6\ \text{V}}{1.28\ \Omega} = 0.469\ \text{A}$ So $I = 0.03\ \text{A} + 0.469\ \text{A} = 0.499\ \text{A}$	**4**
17(b)(i)	Use of $A = \pi r^2$ Use of $R = \frac{\rho l}{A}$ R = 1.28 (Ω) so accurate	**(1)** **(1)** **(1)**	Example of calculation $A = \pi(\frac{0.45 \times 10^{-3}\text{m}}{2})^2 = 1.59 \times 10^{-7}\ \text{m}^2$ $R = \frac{4.89 \times 10^{-7}\ \Omega\text{m} \times 0.416\ \text{m}}{1.59 \times 10^{-7}\ \text{m}^2} = 1.28\ \Omega$	**3**
17(b)(ii)	(As temperature increases) lattice vibrations increase (in amplitude) So (conducting) electrons collide more frequently with the lattice So the resistance increases	**(1)** **(1)** **(1)**	For MP1 and MP2 allow "atoms" or "ions" for "lattice" MP3 dependent on awarding MP1 **or** MP2	**3**
	Total for question 17			**10**

Question Number	Acceptable Answer		Additional Guidance	Mark
18(a)	Light which has a constant phase difference/relationship	**(1)**		**1**
18(b)	Each point on a wavefront is treated as a (new) source (of wavelets) (These) interfere/superpose (to produce a circular wavefront)	**(1)** **(1)**		**2**
18(c)(i)	Distance between the (diffraction) grating and the screen	**(1)**	Allow "distance between grating and central maximum"	**1**
18(c)(ii)	$\theta = 11.3^{o}$ Use of $n\lambda = d\sin\theta$ Distance between each line $=3.32 \times 10^{-6}$(m) (minimum 3sf)	**(1)** **(1)** **(1)**	Example of calculation 650×10^{-9} m $= d \sin 11.3°$ $d = 3.32 \times 10^{-6}$m	**3**
18(c)(iii)	Use of $n\lambda = d\sin\theta$ with $\theta = 90°$ to find n n_{max} = 5.1 (allow 5 if from a correct calculation) Maximum number = 11 (e.c.f. from (c)(ii) for value of d)	**(1)** **(1)** **(1)**	Example of calculation $n_{max} = \frac{3.32\times10^{-6}\text{m}\sin 90}{650\times10^{-9}\text{ m}}$ = 5.1 so 5 orders So total number of dots = 5 + 5 plus central order = 11	**3**
	Total for question 18			**10**

Question Number	Acceptable Answer	Additional Guidance	Mark
19(a)	Energy (supplied) to/per unit charge **Or** Work done (supplied) to/per unit charge **Or** The work done moving unit charge around the whole circuit **Or** The terminal p.d. when there is no current in the circuit **(1)**		**1**
19(b)	Use of $I = \frac{\Delta Q}{\Delta t}$ **(1)** $\Delta Q = 18$ C **(1)**	Example of calculation $\Delta Q = 0.1\text{A} \times 180\text{ s} = 18$ C	**2**
	19 (c) The filament bulb is replaced by a light emitting diode (LED). The resistance of the LED is 50 Ω when the ammeter reads 25 mA. 19 (c) (i) Calculate the rate of energy transferred by the LED.		
19(c)(i)	Use of $P = I^2R$ **(1)** $P = 0.031$ W **(1)**	Example of calculation $P = (0.025\text{ A})^2 \times 50\ \Omega = 0.03125$ W	**2**

19(c)(ii)	Use of sum of e.m.f. = sum of p.d. **(1)** Use of $V=IR$ **(1)** ε =1.5 (V) (which is between 1V and 2V) **(1)** MP3 is dependent on seeing suitable calculations If you see $\varepsilon = IR + Ir$ with one set of correct substitutions, this can score both MP1 and MP2 e.g. $\varepsilon = (0.025 \times 50) + 0.025\ r$	<u>Example of calculation</u> $\varepsilon = 0.1\text{A} \times (5\ \Omega + r)$ $\varepsilon = 0.025\text{A} \times (50\ \Omega + r)$ $0.1\text{A} \times (5\ \Omega + r) = 0.025\text{A} \times (50\ \Omega + r)$ $0.5 + 0.1r = 1.25 + 0.025r$ $0.075r = 0.75$ so $r = 10\ \Omega$ $\varepsilon = 0.1\text{A} \times (5\ \Omega + 10\Omega) = 1.5\ \text{V}$	**3**
19(c)(iii)	**EITHER** The current drawn by the bulb is large(r) **Or** the current drawn by the LED is small(er) **(1)** The p.d. across the internal resistance of the cell is large for bulb **Or** p.d. across the internal resistance of the cell is small for LED **(1)** p.d. for bulb very/too small (so it does not light) **and** p.d. close to 1.5V for LED (so it does light) **(1)** **OR** R of bulb (5 Ω) is smaller than r of the cell (10 Ω) **Or** R of LED (50 Ω) is larger than r of the cell (10 Ω) **(1)** Ratio of resistances in series is the same as ratio of p.d.s in series **(1)** p.d. for bulb very/too small (so it does not light) **and** p.d. close to 1.5V for LED (so it does light) **(1)**	Allow "The resistance of the LED is larger than bulb" or "The resistance of the bulb is lower than LED" Allow greater share of resistance leads to greater share of p.d. or vice versa	**3**
	Total for question 19		**11**