Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCE
Advanced Subsidiary In Physics (8PH0)
Paper 01: Core Physics

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Summer 2024
Question Paper Log Number: P74476A
Publications Code: 8PH0_01_2406_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.
- 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 means of [no ue].

3. Significant figures

3.1 Use of too many significant figures in the theory questions will not be 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 m s^{-2} or 10 N kg^{-1} instead of 9.81 m s^{-2} or 9.81 N kg^{-1} will mean that one mark will not be awarded. (but not more than once per clip). Accept 9.8 m s^{-2} or 9.8 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 Bald (i.e. no working shown) correct answers score full marks unless in a 'show that' question.

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

4.3 **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.

4.4 **recall** of the correct formula will be awarded when the formula is seen or implied by substitution.

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

Question Number	Answer	Mark
1	**The only correct answer is A Energy as this is the only scalar quantity** **B** *is not correct because moment is a vector quantity* **C** *is not correct because momentum is a vector quantity* **D** *is not correct because velocity is a vector quantity*	**1**
2	**The only correct answer is B P and Q have the same magnitude of momentum.** **A** *is not correct because Q moves faster than P as it has a smaller mass and they have the same magnitude of momentum.* **C** *is not correct because Q moves faster than P as it has a smaller mass and they have the same magnitude of momentum.* **D** *is not correct because Q moves faster than P as it has a smaller mass and they have the same magnitude of momentum.*	**1**
3	**The only correct answer is A the only force on the ball is weight** **B** *is not correct because the only force on the ball is weight* **C** *is not correct because the only force on the ball is weight* **D** *is not correct because the only force on the ball is weight*	**1**
4	**The only correct answer is D ammeter reading decreases and voltmeter decreases** **A** *is not correct because the overall resistance of the circuit is increasing, so the current must decrease.* **B** *is not correct because the overall resistance of the circuit is increasing, so the current must decrease.* **C** *is not correct because the current decreases, but as V=IR this would not increase the voltmeter reading*	**1**
5	**The only correct answer is C** $\frac{V}{RnAe}$ **this comes from the rearrangement of** $I = nqvA$**, and substitution for** I **using** $R = \frac{V}{I}$ **A** *is not correct because this answer is rearranged incorrectly* **B** *is not correct because this answer is rearranged incorrectly* **D** *is not correct because this answer is rearranged incorrectly*	**1**
6	**The only correct answer is C** $\sqrt{(2 \times 9.81 \times 0.83) + 1.72^2}$ **from combining the vertical velocity (from** $v^2 = u^2 + 2as$**) and horizontal velocity of the ball** **A** *is not correct because the first part of the expression represents the (vertical velocity)^2 and so should not be squared.* **B** *is not correct because the first part of the expression represents the (vertical velocity)^2 and so should not be squared.* **D** *is not correct because this should be square rooted, as Pythagoras theorem is being used.*	**1**

7	**The only correct answer is C W s from the formula $P = \frac{E}{t}$** **A** *is not correct because this answer is the unit of force x time* **B** *is not correct because this answer is the unit of force* **D** *is not correct because this answer is the unit of momentum*	**1**
8	**The only correct answer is A – The v-t graph is a graph of the gradient of the s-t graph.** **B** *is not correct because this answer shows a decreasing positive velocity, followed by an increasing negative velocity* **C** *is not correct because this answer shows a constant positive velocity followed by a constant negative velocity then an increasing negative velocity* **D** *is not correct because this answer shows a velocity of zero, then an infinite velocity, followed by a velocity of zero again.*	**1**

(Total for Multiple Choice Questions = 8 marks)

Question Number	Acceptable answers	Additional guidance	Mark
9	An explanation that makes reference to the following points: • The force from the wind produces an anticlockwise moment (about the point where the sail attaches to the board) **(1)** • The (weight of the) windsurfer produces a moment in the opposite direction **(1)** • So the windsurfer leans back until the moment due to his weight has increased to equal the (increased) moment of the wind force **(1)**		**3**

(Total for Question 9 = 3 marks)

Question Number	Acceptable answers	Additional guidance	Mark
10(a)	**EITHER** • Use of $F=ma$ **(1)** • Use of $v^2 = u^2 + 2as$ **(1)** • u = 0.58 m s^{-1} **(1)** **OR** • Use of $\Delta W = F\Delta s$ **(1)** • Use of $E_k = \frac{1}{2}mv^2$ **(1)** • u = 0.58 m s^{-1} **(1)**	Example of Calculation -2.2×10^{-3} N $= 0.0085$ kg $\times a$ $a = -0.26$ m s^{-2} $0 = u^2 + (2 \times (-0.26)$ m s$^{-2} \times 0.65$ m) $u = 0.58$ m s^{-1}	**3**
10(b)	• Use of $s = ut + \frac{1}{2}at^2$ for vertical motion **(1)** • Use of $s = ut + \frac{1}{2}at^2$ for horizontal motion **(1)** • s = 0.20 m **(1)**	Example of Calculation $-1.20 \text{ m} = \frac{1}{2} \times (-9.81 \text{ m s}^{-2}) \times t^2$ $\therefore t = \sqrt{\frac{-1.20 \text{ m}}{0.5 \times (-9.81 \text{ m s}^{-2})}} = 0.495$ s $s = 0.40 \text{ m s}^{-1} \times 0.495 \text{ s} = 0.198$ m	**3**

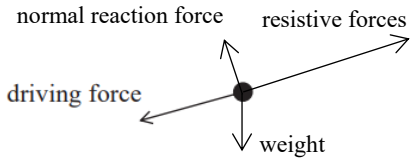
(Total for Question 10 = 6 marks)

Question Number	Acceptable answers	Additional guidance	Mark
11	An explanation that makes reference to the following points: • The balloon applies a force to the (released) air **(1)** • By Newtons 3rd law the air applies a force to the balloon in the opposite direction **(1)** • There is a (resultant) force on the car **(1)** • By Newtons 2nd Law the car accelerates **(1)**	MP4 dependent on MP3	**4**

(Total for Question 11 = 4 marks)

Question Number	Acceptable Answer		Additional guidance	Mark
12(a)	• Uses a micrometer screw gauge • Repeats readings at different places/orientations and calculates a mean	**(1)** **(1)**	Accept digital vernier callipers	**2**
12(b)	• Use of $R = \frac{V}{I}$ • Use of $A = \frac{\pi d^2}{4}$ • Use of $R = \frac{\rho l}{A}$ • $\rho = 1.1 \times 10^{-6}\ \Omega\,\text{m}$	**(1)** **(1)** **(1)** **(1)**	Example Calculation R= 1.96 V / 0.57 A R = 3.44 Ω $A = (\pi \times (0.58 \times 10^{-3}\ \text{m})^2) / 4$ $A = 2.64 \times 10^{-7}\ \text{m}^2$ $\rho = (3.44\ \Omega \times 2.64 \times 10^{-7}\ \text{m}^2) / 0.835\ \text{m}$ $\rho = 1.1 \times 10^{-6}\ \Omega\,\text{m}$	**4**
12(c)	• The area is determined by d^2 • Percentage uncertainty in diameter is doubled. %U = 2 % • The student's statement is incorrect as percentage uncertainty in diameter squared is the greatest percentage uncertainty	**(1)** **(1)** **(1)**	Example Calculation %U(diameter^2) = 2 × 0.8 % = 1.6 % MP3 dependent on MP1 and 2	**3**

(Total for Question 12 = 9 marks)

Question Number	Acceptable answers		Additional guidance	Mark
13(a)(i)	• Weight vertically downwards • Resistive forces acting up the slope • Normal reaction force perpendicular to the slope	**(1)** **(1)** **(1)**	Accept W Accept N or R  	**3**
13(a)(ii)	• Use of $1.2 \times 10^4 \times \sin 11°$ • Use of total force up slope equals total force down slope • Driving force = 240 N	**(1)** **(1)** **(1)**	<u>Example of Calculation.</u> Component of weight parallel to the slope = 1.2×10^4 N × sin11° Component of weight parallel to the slope = 2290 N Driving force = 2530 N − 2290 N Driving force = 240 N	**3**
13(b)(i)	• Evidence of calculation of gradient • Gradient identified as acceleration • Use of $F = ma$ • $F = 1.6 \times 10^4 - 1.9 \times 10^4$ (N)	**(1)** **(1)** **(1)** **(1)**	<u>Example of Calculation.</u> Gradient = (25 – 0) / (3.7 – 0.4) Gradient = 7.6 Acceleration = 7.6 m s^{-2} F = 2400 kg × 7.6 m s^{-2} $F = 1.8 \times 10^4$ N	**4**

13(b)(ii)	• Kinetic energy (of vehicle) transferred to kinetic energy of gravel **Or** Kinetic energy (of vehicle) transferred to thermal energy (of gravel/tyres/ground) **(1)**		**1**

(Total for Question 13 = 11 marks)

Question Number	Acceptable Answer		Additional guidance	Mark
14(a)	• V_{LED} = 0.74 V (read from graph)	**(1)**	Example of Calculation V_R = 6.0 V – 0.74 V = 5.26 V R_R = 5.26 V / 12.5 × 10^{-3} A R_R = 420 Ω	
	• Use of $V_R = V_{PS} - V_{LED}$ **Or** Use of $R_R = R_{TOTAL} - R_{LED}$ **Or** Use of potential divider principle	**(1)**		
	• Use of $V = IR$	**(1)**		
	• R_R = 420 Ω	**(1)**		**4**

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr>
<td>*14(b)</td>
<td>
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 structure and lines of reasoning
<table>
<tr><td>Number of indicative points seen in answer</td><td>Number of marks awarded for indicative points</td></tr>
<tr><td>6</td><td>4</td></tr>
<tr><td>5-4</td><td>3</td></tr>
<tr><td>3-2</td><td>2</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td></tr>
</table>
Indicative content
IC1 Positive potential difference from A (to B)

IC2 So there is a current (12.5 mA) in the LED

IC3 Therefore LED is lit

IC4 Negative potential difference from B (to C)

IC5 So there is no current in the LED
Or
So resistance of LED is (very) high

IC6 Therefore LED is not lit
</td>
<td>
The following table shows how the marks should be awarded for structure and lines of reasoning
<table>
<tr><td></td><td>Number of marks awarded for structure and lines of reasoning</td></tr>
<tr><td>Answer shows a coherent and logical structure with linkage and fully sustained lines of reasoning demonstrated throughout</td><td>2</td></tr>
<tr><td>Answer is partially structured with some linkages and lines of reasoning</td><td>1</td></tr>
<tr><td>Answer has no linkage between points and is unstructured</td><td>0</td></tr>
</table>
Linkage marks
<table>
<tr><td>Number of indicative content points awarded</td><td>Possible linkage marks</td></tr>
<tr><td>0, 1, 2</td><td>0</td></tr>
<tr><td>3, 4</td><td>1</td></tr>
<tr><td>5, 6</td><td>2</td></tr>
</table>
</td>
<td>6</td>
</tr>
</table>

(Total for Question 14 = 10 marks)

Question Number	Acceptable answers		Additional guidance	Mark
15(a)	• Use of charge = area under the graph • Charge in 5 hours = 89 (A h) • 90% charge is 99 (A h) so statement is not correct Or 89 (A h) is 81% charge so statement is not correct	**(1)** **(1)** **(1)**	Q = 0.5(0.5 h ×17.5 A) + 0.5(4.5 h × 2.5 A) + (17.5 h × 4.5 A) Q = 88.8 A h 90% charge = 0.9 × 110 = 99 A h MP3 dependent on MP1	**3**
15(b)(i)	• Use of efficiency $=$ $\frac{\text{useful energy output}}{\text{total energy input}}$ and conversion of kW h to J • Use of $\Delta W = F\Delta s$ • $F = 803$ (N)	**(1)** **(1)** **(1)**	Example Calculation Useful energy output = 0.85 × 42 000 × 3600 Useful energy output = 1.29×10^8 J 1.29×10^8 J = $F \times 160 \times 10^3$ m F = 803 N	**3**
15(b)(ii)	• Use of $mg\Delta h$ • Use of useful energy output = work done against frictional forces + ΔE_{grav} (allow ecf from (b)(i)) **Or** Use of ΔE_{grav} = reduction in work done against frictional forces • Reduction in range = 47 km	**(1)** **(1)** **(1)**	Example Calculation ΔE_{grav} = 1300 kg × 9.81 Nkg^{-1} × 3000m $\Delta E_{grav} = 3.8 \times 10^7$ J 1.29×10^8 J = (803 × s) + (3.8×10^7 J) s = 113 km Reduction in range = 160 km – 113 km = 47 km	**3**

(Total for Question 15 = 9 marks)

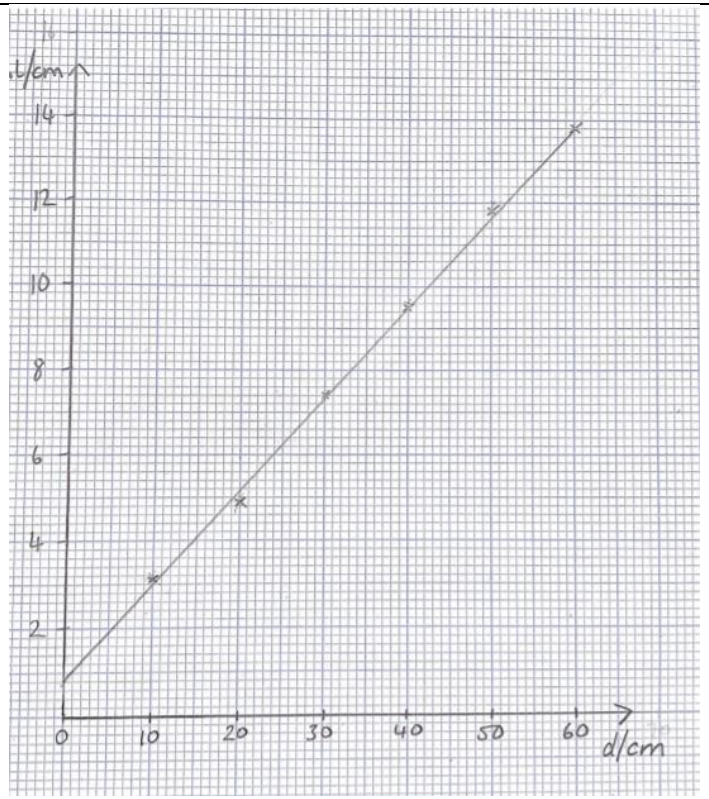
(Total for Section A = 60 marks)

Question Number	Acceptable answers	Additional guidance	Mark
16(a)	• Check that the top of the spring is aligned with zero on the ruler **(1)** • Move the rule close to the spring **Or** Ensure that rule is parallel to the spring **Or** Ensure the metre rule is vertical using a set square **(1)** • View (the rule) perpendicularly **Or** Use a set square to take the measurement from the rule **(1)**		**Max 2**

16(b)(i)

- Processing of data to calculate extension **(1)**
- Axes with labels & units **(1)**
- Scales **(1)**
- Plots **(1)**
- Line of best fit **(1)**

***d* / cm**	***l* / cm**	**Δ*l* / cm**
10.0	6.6	3.1
20.0	8.4	4.9
30.0	10.9	7.4
40.0	13.0	9.5
50.0	15.3	11.8
60.0	17.3	13.8



MP3: scales only in 1,2,5 and must cover at least half of paper

MP4: a 1 mm square tolerance, check all points

5

16(b)(ii)	• Determine gradient using a large triangle • Use of $gradient = \frac{W}{kD}$ • k in range 25.6 – 27.2 • 3 significant figures and unit given	**(1)** **(1)** **(1)** **(1)**	Example Calculation $gradient = \frac{0.138 - 0.008}{0.600 - 0.000}$ Gradient = 0.217 $0.217 = \frac{5.0\ \text{N}}{k \times 0.875\ \text{m}}$ $k = 26.4\ \text{N m}^{-1}$	**4**

(Total for Question 16 = 11 marks)

Question Number	Acceptable answers		Additional guidance	Mark
17(a)	• Use of $W = mg$	**(1)**	Example of Calculation $W = 9.36\ \text{kg} \times 9.81\ \text{N kg}^{-1}$	
	• Calculation of θ	**(1)**	$W = 91.8\ \text{N}$ $\sin\theta = (0.5(5.94\ \text{m} - 2.20\ \text{m})) / (0.5(6.06\ \text{m} - 2.20\ \text{m})$	
	• Resolve forces vertically	**(1)**	$= 1.87/1.93$ $\theta = 75.7°$	
	• $T = 186\ \text{N}$	**(1)**	$2T\cos 75.7° = 91.8$ $T = 186\ \text{N}$	**4**
17(b)	An explanation that makes reference to the following points: • Weight of blanket decreases as it dries	**(1)**	Allow mass for weight	
	• Tension in line decreases	**(1)**		
	• So stress decreases and Young modulus is constant so strain decreases	**(1)**		
	• extension decreases **Or** line gets shorter	**(1)**	MP4 dependent on MP3	
	• height of the blanket from the ground increases	**(1)**	MP5 dependent on MP4	**5**

(Total for Question 17 = 9 marks)

(Total for Section B = 20 marks)
(Total for Paper = 80 marks)

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