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Pearson Edexcel

Mark Scheme (Results)

Summer 2025

Pearson Edexcel International Advanced Subsidiary Level in Physics (WPH11)
Paper 01 Mechanics and Materials

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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.

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Mark Scheme Notes:

This mark scheme is published to help teachers and candidates understand the exam requirements. Please note that the mark schemes can be better understood when viewed alongside the question paper and the Principal Examiner Report for Teachers.

It's important to emphasise that a mark scheme is a work in progress that can be further refined and expanded based on students' responses to a particular paper.

It is important to avoid making assumptions about future mark schemes based on a document from one year.

Although the guiding principles of assessment remain constant, the details may vary based on the content of a particular examination paper.

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. '<u>resonance</u>'

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.

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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 m s^{-2} or 10 N kg^{-1} instead of 9.81 m s^{-2} or 9.81 N kg^{-1} will be penalised by one mark (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 **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.

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Question Number	Answer	Mark
1	**The only correct answer is D (*W*)** A is not correct because upthrust is equal to the weight of liquid displaced B is not correct because upthrust is equal to the weight of liquid displaced C is not correct because upthrust is equal to the weight of liquid displaced	1
2	**The only correct answer is A (The resultant force is zero and the resultant moment is zero)** B is not correct because the resultant moment should be zero C is not correct because the resultant force should be zero D is not correct because the resultant force should be zero and the resultant moment should be zero	1
3	**The only correct answer is B (*t*)** A is not correct because the vertical acceleration is the same for both balls and vertical motion is independent of horizontal motion C is not correct because the vertical acceleration is the same for both balls and vertical motion is independent of horizontal motion D is not correct because the vertical acceleration is the same for both balls and vertical motion is independent of horizontal motion	1
4	**The only correct answer is C (The forces act on the same object.)** A is not correct because the motion of the chair is not relevant B is not correct because forces forming a Newtons' third law pair act in opposite directions D is not correct because forces forming a Newtons' third law pair have the same magnitude	1
5	**The only correct answer is B** ($\overrightarrow{W} + \overrightarrow{T_1} + \overrightarrow{T_2} = 0$) A is not correct because the vector sum of $T_1 + T_2$ is in the opposite direction to W C is not correct because T_2 should not be subtracted from T_1 D is not correct because T_2 should not be subtracted from T_1	1
6	**The only correct answer is B (parabola-shaped graph)** A is not correct because the acceleration is zero C is not correct because the acceleration is zero D is not correct because the acceleration is zero where the line is straight, acceleration changes where the line curves, and acceleration is zero again when the line becomes straight again.	1
7	**The only correct answer is D** ($\sqrt{(15\,000 - 14\,500)^2 + 200^2}$) A is not correct because the answer should be square rooted and the resultant of the vertical forces should be determined before squaring B is not correct because the resultant of the vertical forces should be determined before squaring C is not correct because the answer should be square rooted	1

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8	**The only correct answer is C ($F = W\sin\theta$)** A is not correct because $W\cos\theta$ is perpendicular to the slope B is not correct because $W\cos\theta$ is perpendicular to the slope D is not correct because the resultant force must be zero	**1**
9	**The only correct answer is A ($\frac{50 \times 10^3 \times 2.3}{13}$)** B is not correct because work done should be power × time C is not correct because the answer is inverted D is not correct because work done should be power × time and the answer is inverted	**1**
10	**The only correct answer is A ($\frac{v}{4}$)** B is not correct because conserving momentum does not lead to this answer C is not correct because the new speed is not just the difference between the initial speeds D is not correct because the initial velocities are in opposite directions	**1**

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Question Number	Acceptable Answer	Additional Guidance	Mark
11	Use of $F = ma$ with F = 4800 N **(1)** Use of $W = mg$ **(1)** $W = 150\ 000$ N **(1)**	<u>Example calculation</u> $m = \frac{4800\ \text{N}}{0.31\ \text{m s}^{-2}} = 15\ 500\ \text{kg}$ $W = 15\ 500\ \text{kg} \times 9.81\ \text{N kg}^{-1} = 152\ 000\ \text{N}$	**3**

(Total for Question 11 = 3 marks)

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Question Number	Acceptable Answer		Additional Guidance	Mark
12(a)	Displacement is a straight line (from start to end) (Whereas) distance is the length of the path	**(1)** **(1)**	Allow (whereas) distance is not a straight line Allow the person does not travel in a straight line Allow the path is not a straight line If no other mark scored allow 1 mark for 'displacement is a vector but distance is a scalar'	**2**
12(b)	Two pairs of corresponding values of velocity and time read from graph Calculates gradient of the line between 4 s and 16 s Maximum acceleration = 0.27 m s^{-2}	**(1)** **(1)** **(1)**	No tolerance if readings taken at 4 s and 16 s Allow a tolerance of ±½ a small square if readings taken from other points on the graph <u>Example calculation</u> $a = \frac{5.0\ \text{m s}^{-1} - 1.8\ \text{m s}^{-1}}{16\ \text{s} - 4\ \text{s}} = 0.267\ \text{m s}^{-2}$	**3**

(Total for Question 12 = 5 marks)

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Question Number	Acceptable Answer	Additional Guidance	Mark
13	Use of $v^2 = u^2 + 2a\Delta s$ **(1)** $\Delta s = 1.1$ m **(1)** Comparison of (1.7 + their calculated Δs) with 3.0 m and consistent conclusion **Or** Comparison of their calculated Δs with 1.3 m and consistent conclusion **Or** Comparison of (3.0 – their calculated Δs) with 1.7 m and consistent conclusion **(1)**	allow use of any valid suvat method to determine Δs <u>Example calculation</u> $\Delta s = \frac{(-2.1\ \text{m s}^{-1})^2 - (5.1\ \text{m s}^{-1})^2}{2 \times (-9.81\ \text{m s}^{-2})} = 1.1\ \text{m}$ $s = 1.7\ \text{m} + 1.1\ \text{m} = 2.8\ \text{m}$ $2.8 \neq 3.0$ m, so no	**3**

(Total for Question 13 = 3 marks)

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Question Number	Acceptable Answer		Additional Guidance	Mark
14	Use of $E_k = \frac{1}{2}mv^2$	**(1)**		
	Use of $\Delta E_{grav} = mg\Delta h$	**(1)**		
	Use of efficiency $= \frac{\text{useful energy output}}{\text{total energy input}}$	**(1)**		
	Efficiency = 0.28	**(1)**	Allow efficiency = 28% (must include % symbol) <u>Example calculation</u> $E_k = \frac{1}{2} \times 1800\ \text{kg} \times (14\ \text{m s}^{-1})^2 = 176\ 000\ \text{J}$ $\Delta E_{grav} = 1800\ \text{kg} \times 9.81\ \text{N kg}^{-1} \times 0.76\ \text{m} = 13\ 400\ \text{J}$ $\text{Efficiency} = \frac{45 \times 10^3\ \text{J}}{176\ 000\ \text{J} - 13\ 400\ \text{J}} = 0.277$	**4**

(Total for Question 14 = 4 marks)

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Question Number	Acceptable Answer	Additional Guidance	Mark
15(a)	Compression changes from 60 nm to 97.5 nm **(1)** Use of $E_{el} = \frac{1}{2}F\Delta x$ with corresponding values of F and compression **or** Determines area under graph between 85 N and 140 N **(1)** Increase in elastic strain energy = 4.3×10^{-6} J **(1)**	Allow compression changes from a value between 55 nm and 62 nm to a value between 95 nm and 100nm Allow an answer consistent with their allowed readings from the graph. <u>Example calculation</u> $E_{el} = \frac{1}{2} 140\ \text{N} \times 97.5 \times 10^{-9}\ \text{m} = 6.83 \times 10^{-6}\ \text{J}$ $E_{el} = \frac{1}{2} 85\ \text{N} \times 60 \times 10^{-9}\ \text{m} = 2.55 \times 10^{-6}\ \text{J}$ $\Delta E_{el} = 6.83 \times 10^{-6}\ \text{J} - 2.55 \times 10^{-6}\ \text{J} = 4.28 \times 10^{-6}\ \text{J}$	**3**
15(b)	(The brick) returns to its original size / shape / length when the force / stress is removed **(1)**		**1**

(Total for Question 15 = 4 marks)

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Question Number	Acceptable Answer		Additional Guidance	Mark
16(a)	Mass of the ball-bearing	**(1)**	Allow weight of ball-bearing Allow mass / weight of (a known volume of) oil Allow volume of (a known mass of) oil Allow density of oil Ignore radius / diameter / volume of ball-bearing Ignore density of ball-bearing Ignore temperature of oil	**1**
16(b)	Use of $s = ut + \frac{1}{2}at^2$ with $a = 0$ Use of $F = 6\pi\eta rv$ $\eta = 0.031$ (Pa s)	**(1)** **(1)** **(1)**	<u>Example calculation</u> $v = \frac{0.20\text{ m}}{1.3\text{ s}} = 0.154\text{ m s}^{-1}$ $\eta = \frac{5.6 \times 10^{-5}\text{ N}}{6 \times \pi \times \frac{1.24 \times 10^{-3}}{2} \times 0.154\text{ m s}^{-1}} = 0.0311\text{ Pa s}$	**3**
16(c)	(At a lower temperature) the oil has a greater viscosity (So) the ball falls at a smaller (terminal) velocity (So) time taken is greater (for the ball to fall 20.0 cm)	**(1)** **(1)** **(1)**	MP3 dependent on MP1 or MP2	**3**

(Total for Question 16 = 7 marks)

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Question Number	Acceptable Answer		Additional Guidance	Mark
17(a)	Corresponding force and extension read from graph	**(1)**	Allow a tolerance of ±½ a small square	
	Use of $\Delta F = k\Delta x$	**(1)**		
	$k = 2760\ \text{N m}^{-1}$	**(1)**	Allow a value of k between 2650 and 2850	
	Comparison with 2700 (N m^{-1}) and consistent conclusion	**(1)**	<u>Example calculation</u> $k = \frac{80\ \text{N}}{29 \times 10^{-3}\ \text{m}} = 2760\ \text{N m}^{-1}$ $2760\ \text{N m}^{-1} \approx 2700\ \text{N m}^{-1}$ so this is string Y	**4**
17(b)	Calculates cross-sectional area of string	**(1)**		
	Use of $\sigma = \frac{F}{A}$	**(1)**		
	Use of $\varepsilon = \frac{\Delta x}{x}$	**(1)**		
	Use of $E = \frac{\sigma}{\varepsilon}$	**(1)**		
	$E = 6.0$ GPa	**(1)**	<u>Example calculation</u> $A = \pi \times (0.85 \times 10^{-3}\ \text{m})^2 = 2.27 \times 10^{-6}\ \text{m}^2$ $\sigma = \frac{36\ \text{N}}{2.27 \times 10^{-6}\ \text{m}^2} = 15.9 \times 10^6\ \text{Pa}$ $\varepsilon = \frac{0.002\ \text{m}}{0.750\ \text{m}} = 0.00267$ $E = \frac{15.9 \times 10^6\ \text{Pa}}{0.00267} = 5.96 \times 10^9\ \text{Pa}$	**5**

(Total for Question 17 = 9 marks)

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Question Number	Acceptable Answer	Additional Guidance	Mark
18(a)	Calculates volume of sphere **(1)** Use of $\rho = \frac{m}{V}$ **(1)** $m = 1.1 \times 10^{-2}$ kg **(1)**	<u>Example calculation</u> $V = \frac{4}{3}\pi(7.0 \times 10^{-3}\ \text{m})^3 = 1.44 \times 10^{-6}\ \text{m}^3$ $m = 7.8 \times 10^3\ \text{kg m}^{-3} \times 1.44 \times 10^{-6}\ \text{m}^3 = 1.12 \times 10^{-2}$ kg	**3**
18(b)	Use of appropriate trigonometry **(1)** Initial acceleration = 6.0 m s^{-2} **(1)**	<u>Example calculation</u> Resultant force $= m \times 9.81\ \text{m s}^{-2} \times \sin(38°)$ $= m \times 6.04\ \text{m s}^{-2}$ $F = ma$, so a = 6.04 m s^{-2}	**2**

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***18(c)**	This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning. **Indicative content:** **IC1** (As A falls) the gravitational potential energy of A decreases and the kinetic energy of A increases **IC2** (As A falls) the momentum of A increases **IC3** (During the collision) momentum of A decreases and momentum of E increases **or** During the collision momentum is conserved **IC4** (During the collision the kinetic / total) energy of A is transferred to E **IC5** (As E moves) both the kinetic energy and momentum of E decrease to zero, and the gravitational potential energy of E increases (to a maximum). **IC6** The total energy of A before the collision is equal to the total energy of E after the collision **Or** The final gravitational potential energy of E is the same as the initial gravitational potential energy of A **Or** Total energy of the system remains the same throughout	Marks are awarded for indicative content and for how the answer is 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. Number of indicative marking points seen in answer / Number of marks awarded for indicative marking points 6 / 4 5–4 / 3 3–2 / 2 1 / 1 0 / 0 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 marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning 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	**6**

(Total for Question 18 = 11 marks)

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Question Number	Acceptable Answer	Additional Guidance	Mark
19(a)	Total clockwise moment = total anticlockwise moment **Or** Resultant moment = zero **Or** Sum of all moments = zero **(1)**		**1**
19(b)(i)	Use of trigonometry to determine appropriate component of piston force **Or** Use of trigonometry to determine perpendicular distance from pivot to line of action of piston force **(1)** Use of trigonometry to determine appropriate component of weight **Or** Use of trigonometry to determine perpendicular distance from pivot to line of action of weight **(1)** Use of moment = Fx **(1)** Use of principle of moments **(1)** Minimum force = 22 N **(1)**	<u>Example calculation</u> Moment of F_{piston} about pivot = $160\ \text{N} \times \sin 18° \times 0.37\ \text{m}$ $= 18.3\ \text{Nm}$ Moment of weight about pivot = $95\ \text{N} \times \cos 42° \times 0.70\ \text{m}$ $= 49.4\ \text{Nm}$ $18.3\ \text{Nm} + F \times 1.40\ \text{m} = 49.4\ \text{Nm}$ $F = \frac{49.4\ \text{N m} - 18.3\ \text{N m}}{1.40\ \text{m}} = 22.2\ \text{N}$	**5**

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19(b)(ii)	(each force applied by the student must cause) the same moment (about the pivot) **(1)** (When the force is vertical) The component of the force perpendicular to the rail must be the same **Or** (When the force is vertical) The perpendicular distance from the (line of action of the) force to the pivot is less **Or** If the same (magnitude) force is applied vertically, the moment of the force (about the pivot) is less **(1)** (So when the force is vertical) the force needed is greater **(1)**	MP3 dependent on MP1 or MP2	**3**

(Total for Question 19 = 9 marks)

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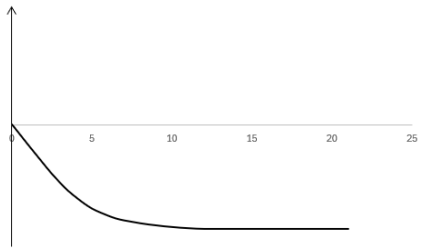
Question Number	Acceptable Answer		Additional Guidance	Mark
20(a)	Use of $s = ut + \frac{1}{2}at^2$ with $u = 0$	**(1)**	allow use of any valid suvat method to determine a	
	$a = 9.78\ \text{m s}^{-2}$	**(1)**		
	Determines an appropriate proportion of g	**(1)**		
	Comparison of calculated value of a with $0.95\,g$ and consistent conclusion	**(1)**	MP4 dependent on MP3 <u>Example calculation</u> $11 = (0.0 \times 1.5) + \frac{1}{2}\,a \times 1.5^2$ $a = \frac{2 \times 11\ \text{m}}{(1.5\ \text{s})^2} = 9.78\ \text{m s}^{-2}$ $\frac{9.78\ \text{m s}^{-2}}{9.81\ \text{m s}^{-2}} = 0.997$ 0.997 is greater than 0.95 so air resistance was negligible	**4**
20(b)	Curved line starting at zero with negative gradient decreasing in magnitude	**(1)**	ignore any values added to the y-axis	**2**
	Horizontal line after 12 seconds	**(1)**	Line should not be along the x-axis <u>Example graph:</u> 	

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20(c)	E_{grav} decreases (throughout) **(1)** While accelerating, E_k increases **(1)** and work is done against air resistance **or** and energy is dissipated due to (work done against) air resistance **(1)** At terminal velocity (E_k is constant and) all ΔE_{grav} is dissipated (due to work done against air resistance) **(1)**	Ignore references to heating Ignore references to thermal energy Allow energy is transferred to the surroundings due to (work done against) air resistance	**4**
20(d)	(When the parachute opens,) air resistance is greater than weight **(1)** (So) resultant force is upwards and acceleration is upwards **or** (so) resultant force is upwards and the skydiver decelerates **(1)** (As speed decreases) air resistance decreases (so acceleration/deceleration decreases) **(1)** (Until upthrust +) air resistance = weight **(1)** (so) resultant force = 0 and acceleration = 0 **(1)**	Allow drag for air resistance throughout Ignore speed decreases Ignore speed is constant	**5**

(Total for Question 20 = 15 marks)
TOTAL FOR PAPER = 80 MARKS

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