Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

January 2025

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

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Introduction

The WPH11 unit covers the understanding and application of the physics related to mechanics and material properties. This exam assessed this knowledge in both familiar and unfamiliar contexts.

The paper tested various skills, including recalling information, applying knowledge to different situations, performing calculations, and giving explanations. Additionally, it examined the understanding of skills gained through core practical experiments.

Several questions asked for candidates to give explanations which involved considering the forces acting on an object, for example questions 13b,18b and 20bii. Many candidates struggled with these questions, often neglecting to consider all of the forces acting in a situation. It may be worth noting that it can often be helpful for candidates to sketch a simple diagram to help remind themselves of the forces acting, or to consider a mathematical approach to help them answer such questions.

Most candidates demonstrated a good ability to answer questions requiring calculations, with most remembering to include relevant units with their answers. There were some exceptions to this though, notably question 15b, which ought to have been a relatively straightforward calculation of efficiency. Most candidates included appropriate units with their calculated answers.

Drawing vector diagrams is a skill that many candidates do well, but is also a skill that many candidates struggle with. When drawing these diagrams, the vectors should be labelled with either the name of the vector or the quantity that the vector represents: it was relatively common to see vectors labelled with the length of the line drawn, which is insufficient. It is also worth noting that candidates should be encouraged to draw arrows in the middle of the vector lines, rather than at the end of the vectors, where the arrow heads can become obscured by the start of the next vector.

Most candidates demonstrated their physics knowledge clearly, even if their use of English was not always perfect. Except for the * question, where the structure of the answer was considered alongside physics understanding, weaknesses in written English were not penalised as long as answers were clear and unambiguous.

Comments on Individual Items

Section A: Multiple Choice

	Subject	Correct response	Explanation
1	Stress-strain graph	**B**	$\text{Gradient} = \frac{\text{Stress}}{\text{strain}} = \text{Young Modulus}$
2	Free-fall motion	**C**	Initially there is no air resistance because neither object is moving, so acceleration is just caused by gravitational force. Once moving, air resistance per unit mass is greater for the feather, so the feather has a much lower terminal velocity and takes more time to reach the ground.
3	Scalars and vectors	**C**	Acceleration has a direction. Energy does not have a direction.
4	Elastic limit	**D**	When stretched beyond the elastic limit, plastic deformation occurs.
5	Acceleration-time graphs	**D**	The area under an acceleration time graph gives the change in velocity of an object. If the object is initially moving, the change in velocity is not equal to the final velocity.
6	Hooke's law	**A**	Spring 1: $F = k\Delta x_{original}$ $\Delta x_{original} = \frac{F}{k}$ Spring 2: $2F = 3k\Delta x_{new}$ $\Delta x_{new} = \frac{2F}{3k}$ $= \frac{2}{3} \times \frac{F}{k}$ $= \frac{2}{3} \times \Delta x_{original}$
7	Displacement-time graphs	**C**	*s* is measured *u* is zero *v* is not known *a* is equal to g, and is what the student is trying to determine *t* is measured. So an equation of motion that includes *s,t,u* and *a,* but not *v* is needed, i.e. $s = ut + \frac{1}{2}at^2$. Substituting into this equation leads to, $s = \frac{1}{2}gt^2$, and a comparison with the equation for a straight line ($y = mx + c$) leads to *s* on the *y*-axis, t^2 on the *x*-axis, and a gradient of $\frac{g}{2}$

8	Velocity-time graphs	**D**	Area under a velocity-time graph = (change in) displacement Area under graph = $\frac{2v+v}{2} \times t + vt$ $= \frac{3v}{2} \times t + \frac{2v}{2} \times t$ $= \frac{5vt}{2}$
9	Free body force diagrams and Newton's second law	**C**	$\Sigma F = ma = 5\text{ kg} \times 4\text{ ms}^{-2}$ and $\Sigma F = 90\text{ N} - 49\text{ N} - \text{drag}$ So $5\text{ kg} \times 4\text{ ms}^{-2} = 90\text{ N} - 49\text{ N} - \text{drag}$ And $\text{drag} = 90\text{ N} - 49\text{ N} - 5\text{ kg} \times 4\text{ ms}^{-2}$
10	Resolving forces	**B**	Tension acts in each direction along the wire. Vertical component of tension is $T \times \sin(\theta)$ Resultant force = 0 So $W = 2T \times \sin(\theta)$ Therefore $T = \frac{W}{2\sin(\theta)}$

Question 11

The majority of candidates scored full marks on this question. Some candidates added the mass of the car to the total mass rather than subtracting, and some did not attempt to subtract the mass of the car at all.

Question 12

Approximately 70 percent of candidates gained some credit on this question, but only around a fifth gained all three marks. Resolving to determine either the component of *g* acting along the slope, or to determine the vertical displacement seemed to cause problems for many candidates.

Candidates could take a conservation of energy approach, or use equations of motion to arrive at their answer, and many examples of each of these approaches were seen. Whichever approach was taken, a large number of candidates either failed to take account of the initial velocity of the person or used a component of the initial velocity, and therefore ended up with an incorrect answer.

Question 13

13(a)

Nearly three quarters of candidates scored full marks on this question, with most of the remaining candidates scoring nothing.

For those candidates who scored nothing, the majority did not pick up on the idea that the change in kinetic energy is equivalent to the work done by the resistive force. These candidates often wrote down the kinetic energy equation, but were unable to get any further. Some candidates equated a change in kinetic energy with a change in gravitational potential energy, and did not appreciate that the escape lane is horizontal so that there is no change in gravitational potential energy of the lorry.

13(b)

A large proportion of candidates struggled to answer this question, with only a small proportion scoring any marks.

Many answers only considered one aspect of the situation, and either described that the car had a lower mass so the resistive force would cause a greater deceleration, or described that the resistive force would be lower and would therefore cause a lower deceleration.

Answers which took a more mathematical approach tended to be more likely to give a full and correct explanation.

Question 14

14(a)

Roughly half of all candidates could describe how Newton's third law applied to the gliders.

Many of those who did not score the mark gave a statement describing Newton's third law, but did not describe how this applied to the gliders. It was also relatively common to read incomplete descriptions of the situation – for example stating that the gliders exerted equal forces, but not stating what the forces were exerted on, or omitting to mention that the forces act in opposite directions. There were also a significant minority of answers that referred to conservation of momentum and did not mention forces at all.

Some candidates described glider B as exerting 'the same but opposite force' on glider A. 'The same' could be referring to the same type of force, which is correct, but was not sufficient to score the mark, as it needed to be clear that the forces between the gliders were also equal in size (as well as being opposite in direction).

14(b)

Over 90 percent of candidates gained some credit on this question, with about 40% gaining all three marks.

The majority of candidates could apply the equation for momentum. When conserving momentum, a common error was to use positive values of momentum for both gliders. It was also relatively common on this question for candidates to forget to include units in their calculated value for either momentum or for velocity, which prevented them from scoring the second marking point. A number of candidates either did not state the final direction of motion, or did not give a conclusion about whether the prediction was correct, and so did not gain the final mark.

Question 15

15(a) and 15(b)

Question 15(a) tended to be well answered, with the majority of candidates scoring at least one mark and many scoring all five marks. In contrast with question 12, it was very common to see answers here that correctly resolved the length of the pipes to determine the change in height of the water.

Question 15(b), on the other hand, was not answered well, with many candidates failing to consider what the useful output power was, or what the total input power was. It was very common for candidates to add the wasted power to the total input power, and it was very common for candidates to use 88 MW or 4 × 88 MW as the useful power output.

Slightly less than a quarter of all candidates scored full marks on both 15(a) and 15(b) .

Question 16

16(a)

Over a quarter of all candidates gained no marks on this question, with approximately four in ten candidates gaining both marks.

Many candidates gave a description that the clockwise moments should equal the anticlockwise moments, which is not quite correct - to score the second marking point they needed to be clear that to the **total** clockwise moment is equal to the **total** anticlockwise moment in equilibrium.

16(b)

Around two-thirds of candidates scored at least 3 marks on this question, with over a quarter of all candidates gaining all 6 marks.

Candidates could take a number of different approaches, and it did not matter whether candidates applied the principle of moments firstly to the initial situation or firstly to the new situation. Alternative approaches to the question, such as using the principle of moments alongside using the fact that the resultant force would be zero to arrive at a valid answer, were rarely seen but could also gain full credit.

Some answers used lengths in cm and some used lengths in metres, but so long as this was consistent throughout the answer this was correct physics so did not affect the marks awarded. Some candidates forgot to subtract the weight of the dish from the weight of the dish and rice. As with all 'deduce' type questions, a final conclusion was needed which some candidates did not include.

Question 17

17(a)

This question was answered well, with approximately three quarters of candidates gaining both marks.

The most common error was for candidates to use the new length of the sample instead of using the change in length.

Candidates who used the change in length as the numerator, but used the new length instead of the original length as the denominator when applying the strain equation, scored the first marking point.

17(b)(i)

Nearly 90% of candidates gained some credit, with just over 40% gaining full marks.

Common errors included treating the diameter as a radius when calculating the cross-sectional area of the sample, or forgetting to square the radius or diameter.

Some candidates incorrectly used a point on the graph to calculate a value for the Young Modulus, and then attempted to use this to determine the stress in the sample.

There was also a noticeable proportion of candidates who used a value of 110, but treated this value as 110 Pa rather than 110 MPa.

17(b)(ii)

This question proved challenging for many candidates, with slightly less than 40% scoring any marks.

For those who did gain some credit, the most common marks awarded were for stating that the area under the graph multiplied by the volume would give the energy stored, or for identifying that the volume of the rope is equal to the cross-sectional area multiplied by the length of the rope.

Question 18

18(a)

Approximately a fifth of candidates gained full marks, with about three quarters scoring at least one mark.

It is conventional to draw arrows in the middle of vector lines. Candidates who drew arrows at the ends of the lines could still gain credit for this, but it was often difficult to identify the arrow heads as they had a tendency to overlap the other vector lines. Many candidates drew a free-body force diagram rather than a scaled vector diagram.

Many candidates labelled their vectors with the length of the arrow they had drawn, rather than with the size or description of the force that each arrow represented.

It was not uncommon for candidates who drew an appropriate triangle to draw the resultant force vector pointing in the wrong direction.

18(b)

Around 60% of candidates gained some credit on this question.

Although the question stated that the drag force should be assumed to be negligible, some candidates still gave answers that referred to the drag force. This did not prevent credit from being awarded.

Many responses described the forces acting before the submarine was moving at a constant speed, before going on to answer the question. When this happened, descriptions and explanations of how forces varied before the submarine was moving upwards at a constant speed were ignored.

Some responses described the situation when the submarine was fully submerged, and then when the submarine was completely out of the water, but not how the forces changed as the submarine moved between the two situations.

A misconception shown by a small minority of candidates was the idea that the pressure from the water acting on the submarine caused a downwards force on the submarine which was greater at greater depths.

The idea that the volume / mass / weight of displaced water decreased as the submarine moved out of the water was probably the idea that was least well described by candidates.

There was a noticeably proportion of completely blank answers.

Question 19

19(a)

Most candidates gained some credit on this question, with around a fifth scoring all 7 marks.

In Question 19(a)(i), some candidates mis-interpreted the question and tried to show that the projectile was above the ship rather than below it after 30 seconds, instead of trying to show that it took about 30 seconds for the projectile to be over the ship. These answers often did not gain credit for (a)(i) but valid working shown in part (i) could contribute to any marks scored in part (ii).

Some candidates were unable to correctly resolve the initial velocity, either using no trigonometry at all, or using the incorrect component.

If candidates showed working to calculate both 500 × sin(20°) and 500 × cos(20°), they needed to be clear which of these was representing each component of the velocity in order to gain credit for this.

In question 19(a)(ii), it was relatively common for candidates to forget to add the initial height of the projectile to their calculated change in height. Some candidates calculated the maximum height that the projectile would reach, instead of the height above the ship.

19(b)

About a third of candidates gained at least one mark on this question.

Candidates who referred to the horizontal and vertical components of the initial velocity tended to score the first two marking points. Some candidates just referred to $\sin(\theta)$ and / or $\cos(\theta)$, without making it clear how these linked with the vertical and horizontal components, which was not sufficient to score these two marks.

Only a small proportion of candidates referred to the link between the initial vertical component of velocity and the time of flight, and it was relatively uncommon for candidates to link both the horizontal velocity and the time taken with the distance travelled.

Many candidates mentioned 45° in their answers, but this did not gain any credit.

Question 20

20(a)

Many candidates made a good attempt at answering this question.

There was a noticeable proportion of answers that described the conditions for Stokes' law instead of answering the question that was asked.

Some answers made general statements that drag increases when speed increases, without actually stating that the sphere would increase in speed, and so did not score MP2 or MP3.

It was reasonably common for answers to just describe the forces acting when the sphere moves at terminal velocity, without explaining why the sphere would reach terminal velocity after being released from rest.

20(b)(i)

This calculation was well answered with over half of candidates gaining full credit.

The most common errors that prevented full marks were from candidates who treated the '*v*' in Stokes' law as a volume rather than a velocity, or from candidates who made errors when using standard form and ended up with a power of ten error.

Some candidates calculated the velocity of the sphere correctly but rounded this to one significant figure before then using this value in the Stokes' law equation. This led to an incorrect final answer, and meant that the final marking point was not awarded.

20(b)(ii)

Around 40% of candidates gained some credit on this question, but very few scored all three marks.

In common with question 13(b), most answers did not consider all of the forces acting and tended to refer to only one force. This led to incorrect conclusions, for example stating that drag on the larger sphere is greater, so the terminal velocity is lower and the time taken is greater. I suspect that, had they stopped to imagine a tiny sphere and a larger sphere falling through a fluid they would have realised that the larger sphere would fall faster and take less time – multiple choice question 2 included a similar concept, and over half of candidates answered that question correctly.

Some candidates used a mathematical approach, showing that volume is proportional to radius cubed, and drag is proportional to radius, and using this to guide their answers. Candidates taking this approach tended to answer well, as long as they remembered to consider all forces acting.

A fair number of candidates referred to the time taken for the sphere to reach terminal velocity, rather the time taken to fall 0.45 while travelling at terminal velocity.

Concluding remarks

Candidates showed a broad range of knowledge and skills on this paper. It was encouraging to see some excellent answers, and particularly pleasing to see a large number of candidates able to correctly work through some of the multi-step calculations.

While most demonstrated a solid understanding of key physics concepts, paying closer attention to detail—especially in explanations—would further improve performance. When discussing the relationship between forces and motion, candidates should aim to consider all the individual forces acting, as well as considering the resultant force in order to give comprehensive answers.

The recommendations for improving student performance remain consistent with those from previous series, including:

- Avoid excessive rounding of intermediate values in multi-step calculations, as this can lead to inaccurate final answers.
- Always include appropriate units in calculated values and carefully check unit prefixes (kilo, mega, milli, etc.) and powers of ten, especially when interpreting values from graphs.
- Encourage candidates to read questions carefully and review their answers to reduce errors and misunderstandings.
- Help candidates visualise scenarios and compare their written answers—whether calculations or explanations (e.g., the falling ball bearing question)—with their imagined real-world outcomes to identify potential mistakes.
- Provide practice in applying fundamental principles across different contexts to build confidence and enhance problem-solving skills.
- Emphasize the importance of accurately understanding and recalling physics terms and quantities.

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