Qualification Accredited

Oxford Cambridge and RSA

AS LEVEL

Examiners' report

PHYSICS B (ADVANCING PHYSICS)

H157
For first teaching in 2015

H157/02 Summer 2019 series

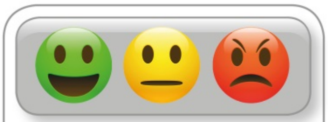
Version 1

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.



Paper 2 series overview

Candidates found this paper more accessible than the 2018 paper and were more successful in this paper resulting in higher scores throughout.

The entry was very small, reflecting the smaller uptake in AS examinations.

In last year's report, it was observed that less successful candidates had difficulty with re-arranging algebraic equations, made errors involving powers of 10 when converting between SI prefixes and bases units (e.g. nm to m), often failed to see the development of a theme between consecutive sub-parts of a question, attempting (for example) to answer part (g)(ii) on the way to answering (g)(i), when they should be asking themselves, 'How does the answer to (g)(i) lead on to (g)(ii)?' which may suggest the approach that's necessary for (g)(i) as well – examiners do attempt to make the earlier parts of these structured questions more straightforward than the subsequent ones. These shortcomings were found in this year's candidates also, but more successful candidates had a clearer view of what the actual demands of the questions were and were less distracted by misconceived ideas about what the question was asking.

Note

From this series students have been provided with a fixed number of answer lines and an additional answer space. The additional answer space will be clearly labelled as additional and is only to be used when required. Teachers are encouraged to keep reminding students about the importance of conciseness in their answers. Please follow this link to our SIU:
https://www.ocr.org.uk/administration/support-and-tools/siu/alevel-science-538595/

Section A overview

The five question in this section were shorter and intended to be more sharply focused on the question context than in the longer questions following.

Question 1 (a)

1 Fig. 1 is the stress-strain graph for a sample of steel which was extended until it fractured.

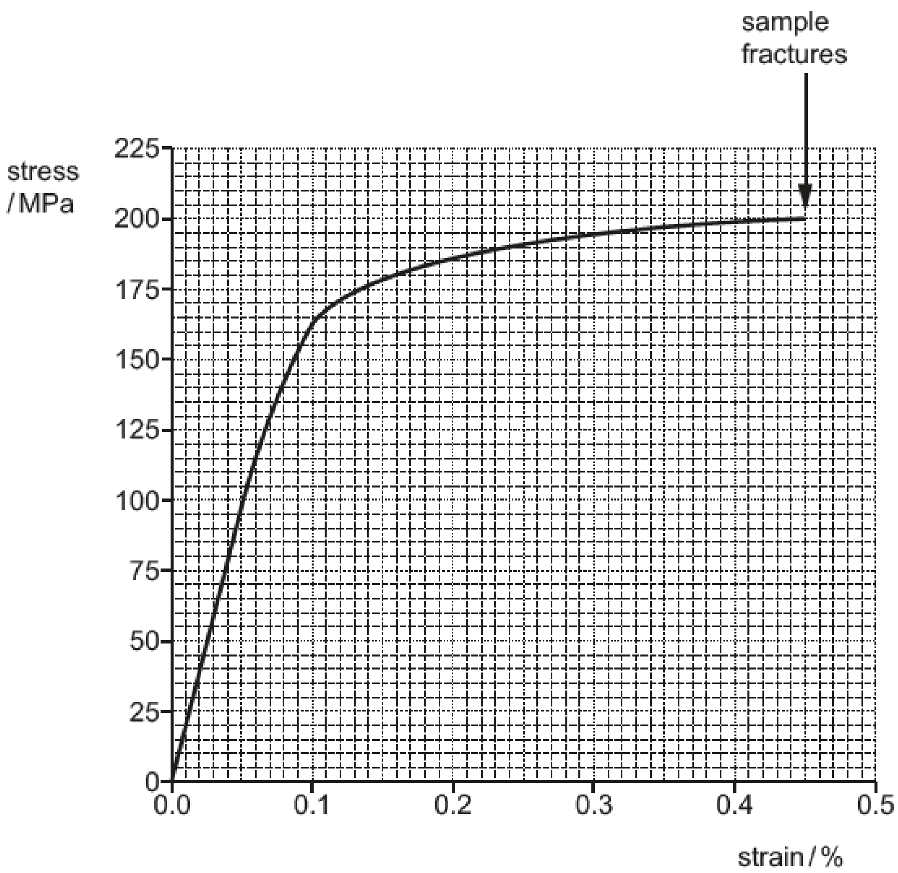


Fig. 1

The sample used to obtain these results was a cylindrical rod of length 31.0 cm and diameter 13.0 mm.

Use these data, together with the graph, to make the following calculations. Show your working clearly in each case.

(a) Calculate the length of the rod just before fracture. Express your answer to 3 significant figures.

length = ... cm **[2]**

Question 1 (b)

(b) Calculate the force *F* that was required to produce a strain of 0.1%.

F = ... N **[3]**

Question 1 (c)

(c) Calculate the Young modulus *E* for small strains.

E = ... Pa **[3]**

In this question, expressing strain as a percentage handicapped many candidates who lost marks in both part (a) and part (c), although error-carried-forward limited the damage in each case. Less successful candidates also omitted to convert MPa to Pa, resulting in Power-Of-Ten errors.

In part (c) many candidates did not have a clear concept of the Young modulus as the stress-strain ratio for the initial ($\varepsilon \propto \sigma$) section of the graph, with the consequence that corresponding value of ε and σ beyond that region were often chosen. A number of mathematically quite fluent candidates were so fixed on calculating $E = FL/Ae$ that they gave themselves quite a bit of extra work – some of these even re-calculated the extension and area they had previously used in parts (a) and (b). The best responses clearly realised that they needed the gradient of the linear region, but extrapolated the line to give a larger triangle and so a better (and easier) calculation of *E*.

Question 2 (a)

2 This question is about the absorption of light by rod-shaped sensitive cells in the retina of the human eye. Fig. 2 shows how efficiently these cells absorb light of different wavelengths across the range of visible light (400 – 700 nm).

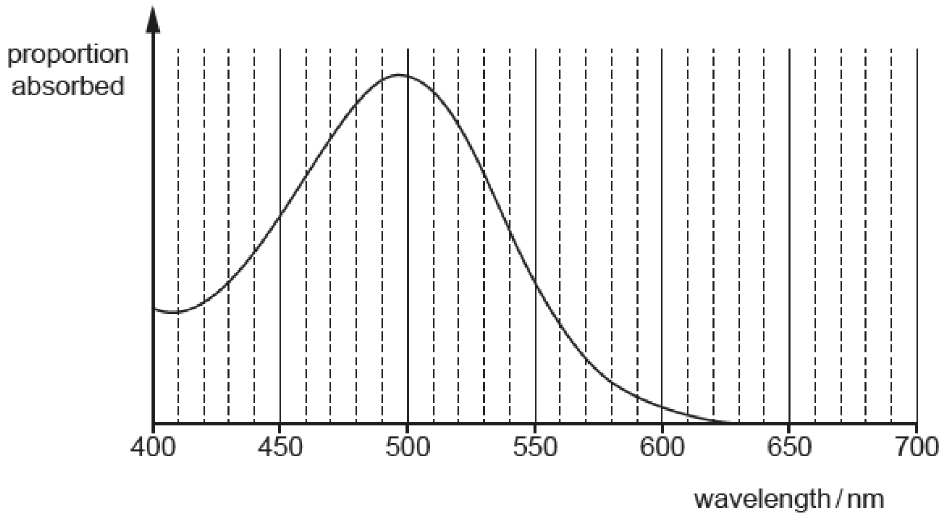


Fig. 2

(a) A typical rod cell can be activated (switched on) by a single photon.

Show that the energy required to activate a rod cell detecting light at the wavelength to which it is most sensitive is less than 5×10^{-19} J.

[3]

Question 2 (b)

(b) The responses from neighbouring rod cells are added to send a signal to the brain. A constant light is seen coming from the direction viewed if at least twelve neighbouring cells are activated during a time interval of 100 ms.

Calculate the smallest value of power of visible light absorbed by rod cells to give a constant light signal.

power = ... W **[2]**

A surprising number of candidates did not use the graph accurately enough to identify the wavelength at which the rod cells are most sensitive (answer had to be > 490 nm and < 500 nm for the first marking point). Most candidates were able to find the photon energy, either from $f = c/\lambda$ followed by $E = hf$ or from $E = h\lambda/c$. Again, some candidates lost a mark due to not converting nm to m correctly. Conversion from E to P by dividing by 100 ms was done well by all.

Question 3

3 The comb shown in Fig. 3.1 has 53 teeth in a distance of 5.0 cm. It is mounted parallel to a wall 3.6 m away.

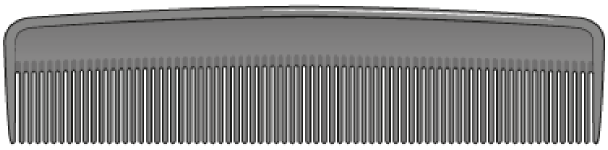
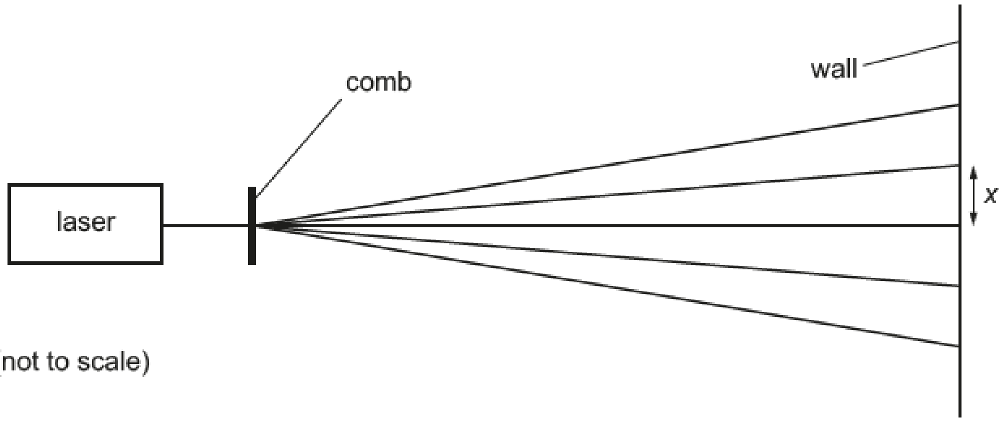


Fig. 3.1

A laser emitting light of wavelength 630 nm is set up perpendicular to the comb and produces an interference pattern of red dots on the distant wall as shown in Fig. 3.2.



(not to scale)

Fig. 3.2

Calculate the separation *x* of the dots on the wall.

x = ... m **[3]**

The gap size in the comb was allowed as either 5.0 cm/53 or 5.0 cm/52 in this question, The Young's slits equation $x/L = \lambda/d$ was used by at least half of the candidates, and that was acceptable. A surprisingly large number of those using the diffraction grating equation calculated θ from sin θ and then used tan θ to find *x*, which was fine, but just extra work for them – only one or two realised that, at small angles $\sin\theta \approx \tan\theta$ as detailed in the data formulae and relationships booklet. This small angle approximation is integral to the derivation of the Young's slits equation, so candidates need to be comfortable with its application.

i	**OCR support**	Candidates should be familiar with the Data formulae and relationship booklet. If they are issued with a copy at the start of AS and use it consistently, then they will be aware of the contents and familiar with position of items. https://www.ocr.org.uk/Images/363835-units-h157-and-h557-data-formulae-and-relationships-booklet.pdf

Question 4 (a)

4 The graph of Fig. 4 shows the current in each of two different components **A** and **B** when potential differences from 0 to 7.0 V are applied across them.

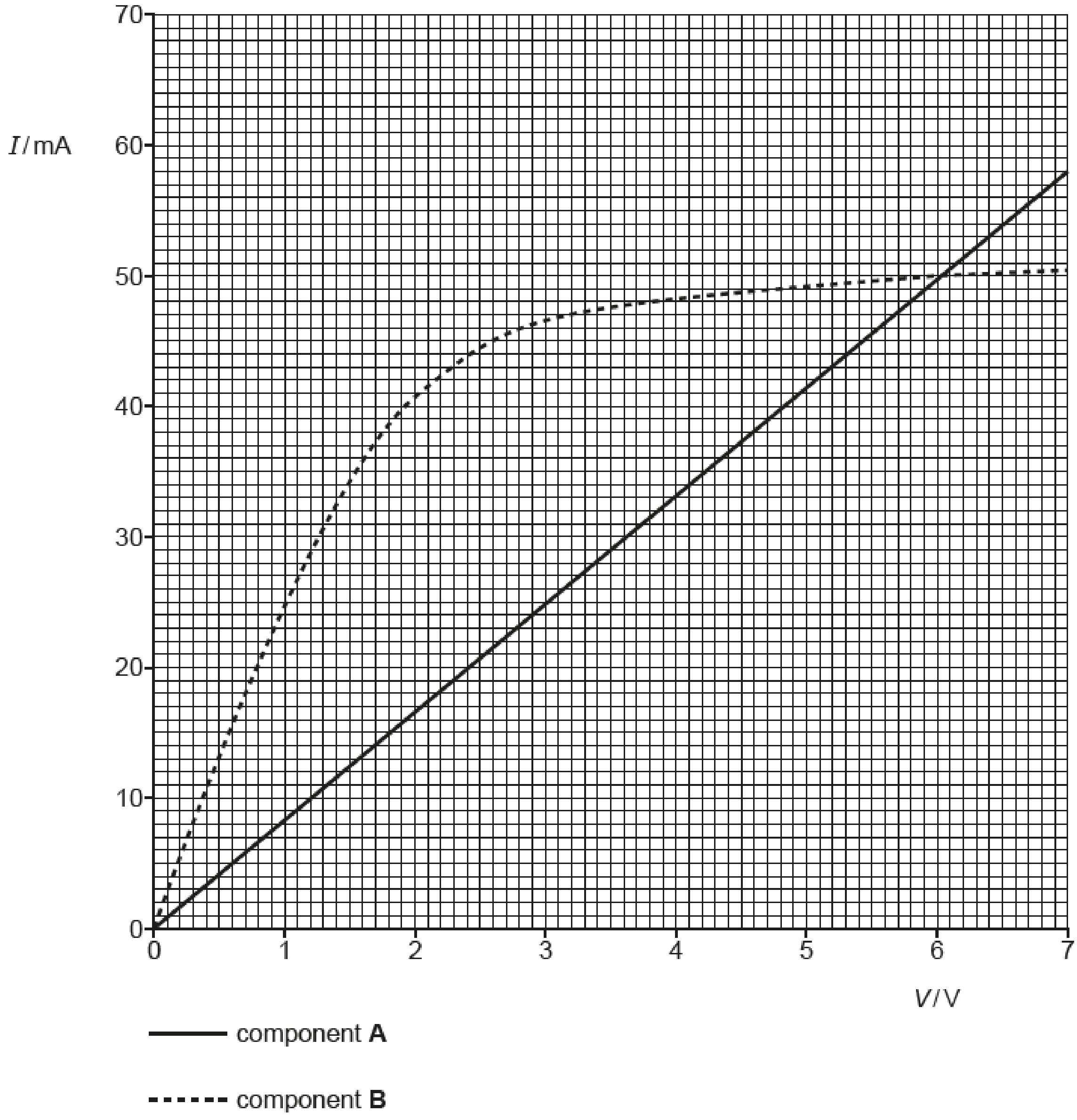


Fig. 4

(a) The two components are connected, in parallel, between the terminals of a battery of e.m.f. 3.0 V with negligible internal resistance.

Calculate the conductance of the parallel combination of **A** and **B** in this case. Show your working clearly.

conductance = ... S **[3]**

Question 4 (b)

(b) **A** and **B** are now connected in series to a battery of e.m.f. 6.0 V with negligible internal resistance.

Explain why the graph of Fig. 4 shows that the current through **A** and **B** must be about 36 mA.

....

....

....

.... **[2]**

The most popular approach in part (a) was to work through resistance equations and then use $G = 1/R$, which was acceptable, if rather longer. There were a number of errors consequent on not converting correctly from mA to A, and these lost a mark with the usual error-carried-forward procedure to avoid losing all the marks for a single error. It was encouraging that most candidates understood the correct physics needed for part (a), although many did not use 3.0 V in reading the currents, and some incorrectly assumed that G was given by the gradient of the I-V curve (or its equivalent using R) rather than using the values at the correct voltage, although the assumption is true for the ohmic graph A. Part (b) proved difficult for candidates at all levels; explaining in words is often much harder than calculation, revealing where misconceptions about current and p.d. lurk.

Question 5 (a)

5 Fig. 5 shows a trolley of weight 8.2 N rolling down a ramp inclined at 35° to the horizontal. You can assume that there is very little friction between the trolley and the ramp.

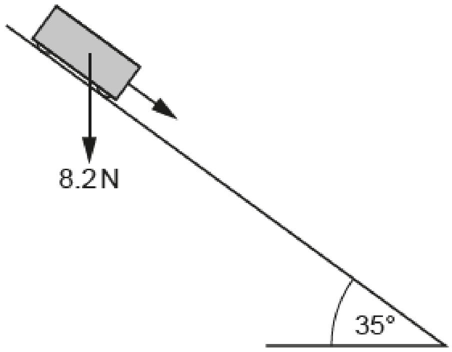


Fig. 5

(a) Calculate the acceleration *a* of the trolley along the ramp.

a = ... $m s^{-2}$ **[3]**

There were different possible approaches to this question. The most successful candidates found the component of the weight parallel to the slope and used this with the mass, from $m = W/g$, to find the acceleration. Others realised that the required acceleration would be the component of g parallel to the slope and found that, and then used $\Delta E_k = \Delta E_{grav} = mg\Delta h$ to find the energy in (b). For less successful candidates attempting resolution by either method it seemed to be a random choice between sin and cos, and between 35° and 55°; fortunately for many, this does give a 50:50 chance of success.

It was clear that many had a hazy understanding of resolution of force or acceleration: very few candidates drew vector resolution sketches by the diagram, and this would have helped many.

Question 5 (b)

(b) Calculate the kinetic energy gained by the trolley as it travels 68 cm along the ramp.

kinetic energy gain = ... J **[1]**

Many candidates did not realise that all they needed to do was to find the work done by the force from (a) in moving through a displacement of 0.68 m.

An alternative approach used by many was to use $E_k = \Delta E_{grav} = mg\Delta h$. It was also possible (of course) to use $v^2 = u^2 + 2as$, $m = W/g$ and $E_k = ½ mv^2$ and this was seen, but it was not an efficient use of time and gave extra opportunities for errors *en route*.

Section B

Question 6 (a) (i)

6 This question is about the structure and properties of metals.

(a) Fig. 6.1 shows one layer of the crystal structure of copper metal. The copper atoms are all spherical.

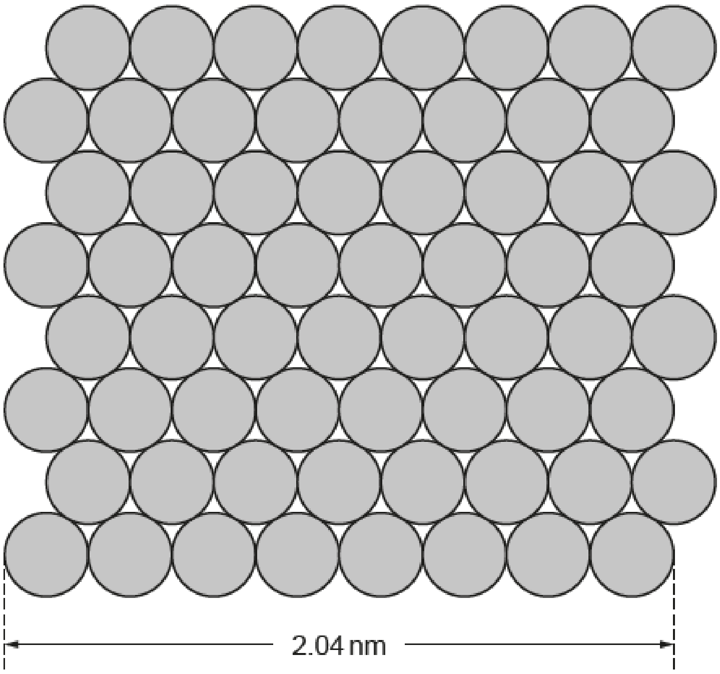


Fig. 6.1

The length of the bottom row of copper atoms was measured directly with a Scanning Tunneling Microscope.

(i) Use data from Fig. 6.1 to show that the volume V of a copper atom is about $9 \times 10^{-30}\,m^3$.

[3]

Question 6 (a) (ii)

(ii) The mean molar mass of copper is 63.5 g.

1 mole of copper = N_A atoms, where $N_A = 6.02 \times 10^{23}$ atoms mol^{-1}.

Calculate the mean mass m of a single copper atom.

m = ... kg **[2]**

Question 6 (a) (iii)

(iii) Density ρ is defined as the mass per unit volume of a material: $\rho = \frac{m}{V}$

Use the answers to **(i)** and **(ii)** to calculate the mean density of a copper atom.

mean density of a copper atom = ... kg m^{-3} **[1]**

Question 6 (a) (iv)

(iv) The density of copper in the data book is 8920 kg m^{-3}.

Suggest and explain one reason for the difference between the value obtained in **(iii)** and the measured density of copper.

....

....

....

.... **[2]**

Parts (a) (i) to (iii) were closely structured to guide candidates to obtain the density of a spherical copper atom, and most followed this successfully, although some odd formulae for the volume of a sphere were seen even though this is given in the data formulae and relationships booklet. In part (iv) the more successful candidates realised that the preceding calculation omitted the spaces between the close-packed spheres, and that the effective volume per atom should be larger, which would give a lower density. Less successful candidates tried to attribute the difference on other factors, such as the existence of different isotopes of copper in the metal, or the presence of dislocations.

Question 6 (b)

(b)* One particular copper alloy consists of 95% copper and 5% zinc. The table compares the masses and sizes of the two atoms.

$\frac{\text{mass of zinc atom}}{\text{mass of copper atom}}$	$\frac{\text{diameter of zinc atom}}{\text{diameter of copper atom}}$
1.03	1.04

The structure of the alloy crystal is shown in Fig. 6.2.

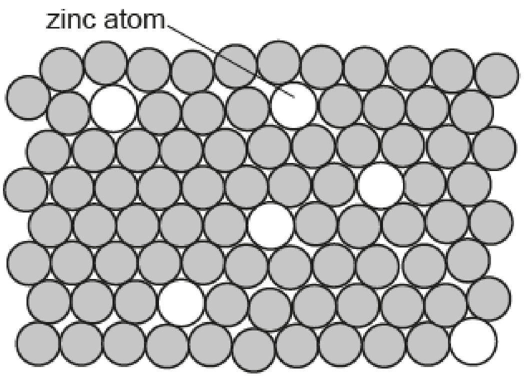


Fig. 6.2

This alloy is used to make coins.

Use the information from the table and Fig. 6.2 to suggest and explain differences between the physical properties of copper and this alloy and suggest and explain how these differences make the alloy more suitable than copper for making coins. **[6]**

....

....

....

....

Most of the candidates realised that they needed to compare the diagram of Fig. 6.2 with Fig. 6.1 and use data from the table – only the relative diameters were significant here.

Exemplar 1 is a Level 3, 6 mark response. Although the first paragraph effectively covers all the points needed, it is important to stress that the context is not one which would be expected to be known to the candidate, who has to suggest reasons for the suitability of the alloy in the context of coinage. The second paragraph is not actually an important issue in practice, but the suggestion is reasonable and fits the generic marking instructions for Level 3: *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* This response gains full marks.

Exemplar 2, on the other hand, shows a candidate who realised that the issue was something to do with dislocations in crystals, but did not explain it clearly or relate it to important issues for coins. It was judged to be better than Level 1 but not fully meeting the Level 2 criteria (*There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.*) and was given Level 2, 3 marks.

Exemplar 1

The structure of the alloy crystal is shown in Fig. 6.2.

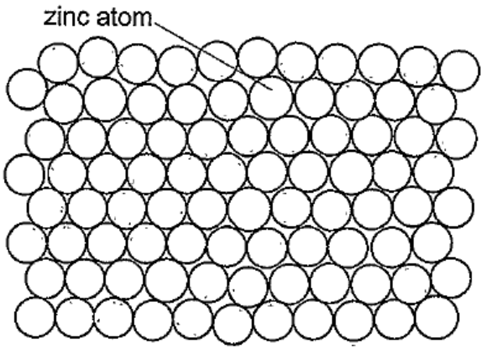


Fig. 6.2

zinc is heavier and has a larger diameter

This alloy is used to make coins.

Use the information from the table and Fig. 6.2 to suggest and explain differences between the physical properties of copper and this alloy and suggest and explain how these differences make the alloy more suitable than copper for making coins. **[6]**

zinc has a larger diameter than copper so when placed in the regular copper lattice it creates a stress field around it which blocks the passage of dislocations. This means that more stress can be exerted on the coin before it deforms as the atom layers require more energy to slip over each other. Copper alone would deform to easily so coins would need to be replaced by the government more frequently which costs money.
Zinc is heavier so different zinc % in a coin allows a variation in weight so machines can more easily distinguish between coins of different values and spot fake coins. It would be much easier to produce fake coins if only copper was used as there is only one element, but introducing zinc means it is much harder to produce the right ratio of copper : zinc mass

A high-scoring example of the first 6 mark extended response in this paper. Exemplar 1 was clear, well-organised and linked to the context of the question. It scored the maximum marks at Level 3, 6/6.

Exemplar 2

Use the information from the table and Fig. 6.2 to suggest and explain differences between the physical properties of copper and this alloy and suggest and explain how these differences make the alloy more suitable than copper for making coins. **[6]**

using copper as an alloy means that it is more easily broken or bent as it's a softer metal than zinc. so zinc coins would last longer. mass and diameter of zinc atoms are larger than copper therefore less is used to make up a coin which makes it better value in money However zinc coins would be heavier than copper. zinc in copper coins stop dislocations happening therefore the coins dont break as easily

This exemplar was typical of many seen in marking: the essential physics was present, but not clearly organised and explained, and it was not linked to the context of the question. It scored Level 2, 3/6

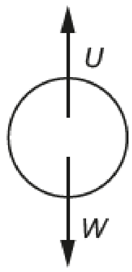
Question 7 (a)

7 This question is about the movement of a table-tennis ball falling in air.

On release, but before the ball starts moving, there are two forces acting on it:

- Its weight, W
- The upthrust, U, which is equal to the weight of air which would have occupied the space that the ball now occupies.

These forces are shown in Fig. 7.1



(not to scale)

Fig. 7.1

(a) Show that the upthrust U acting on a table-tennis ball in air of density 1.2 kg m^{-3} is less than 2% of the weight W of the ball.

weight of table-tennis ball = 0.026 N

volume of table-tennis ball = 3.4×10^{-5} m^3

[4]

The question stem introduced and explained a concept not dealt with in the course, Archimedean upthrust, which the candidates were then required to calculate using ideas of density, mass and weight. Many managed this convincingly, although some confused mass with weight resulting in a factor of 0.15% instead of 1.5%, which is still less than the 2% asked in the question.

Question 7 (b)

(b) When the ball moves at a velocity *v*, it experiences a force *D* due to air drag given by

$D = ½\, \rho\, A\, C_d\, v^2$

where ρ is the air density, *A* is the cross-sectional area of the ball, and C_d is a dimensionless constant called the drag coefficient.

radius of table-tennis ball = 0.020 m

density of air = 1.2 kg m^{-3}

the drag coefficient C_d = 0.4 for a table-tennis ball falling in air

Use the data above to calculate the drag force acting on a table-tennis ball at its **terminal velocity** of 9.3 m s^{-1} and explain why you would expect the drag to have this value.

D = ... N

....

....

....

....

.... **[3]**

On this part, accurate substitution of values into the given equation should give a drag force *D* of 0.026 N (to two significant figures) which many did for the first two marks, although carelessness such as not squaring *v* did lose marks. The third mark required the candidate to realise that the emboldened **terminal velocity** was a hint to consider the physics applying to an object moving at constant velocity in a straight line which less successful candidates ignored; a number unfortunately chose to quote Newton's Third Law at this point. Most who gained the last mark did not consider upthrust in the equilibrium, but this was acceptable here, as *U* is relatively small, as shown in part (a).

Question 7 (c) (i)

(c) The graph in Fig. 7.2 shows how the displacement s of the table-tennis ball changed with time t from the instant it was released.

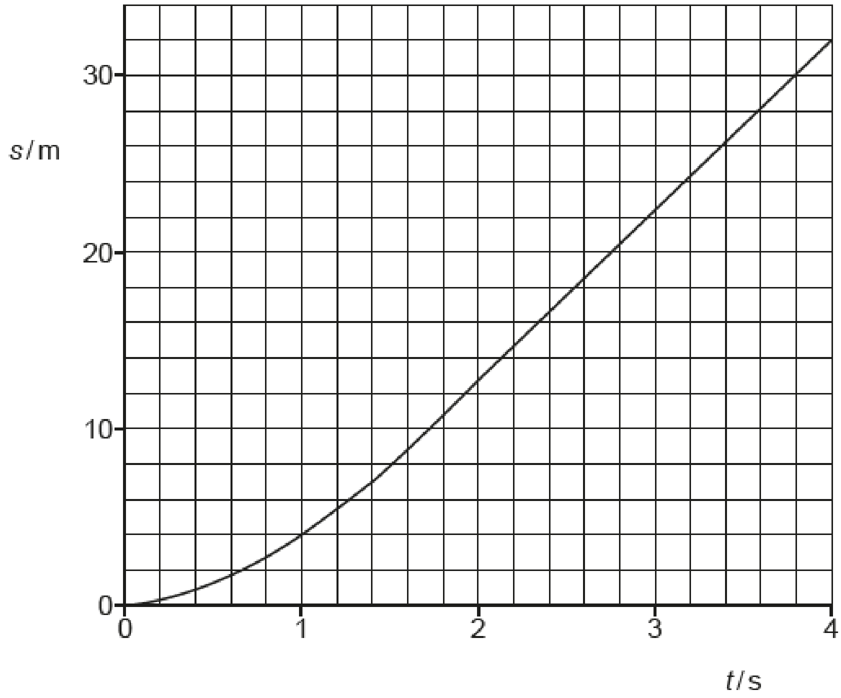


Fig. 7.2

(i) Calculate, as accurately as the data allow, the velocity v of the ball after it has fallen for 1 s.

Show your working.

v = ... m s^{-1} **[3]**

Question 7 (c) (ii)

(ii) State how the graph shows that the ball has reached its terminal velocity within about 3 s of being released.

....

....

.... **[1]**

In Question 7(c)(i), many candidates, even strong ones, did not pick up the instruction 'as accurately as the data allow' in the question stem and did not draw a reasonable tangent at t = 1 s or else used too small a triangle to calculate its gradient. Weaker candidates tended to divide s at t = 1 s by 1.

Virtually all candidates correctly equated the straight line section with constant velocity, so no longer accelerating; a few spoiled this by saying that the graph showed that s was proportional to *t.*

Question 7 (d)

(d) Explain how the way in which a table-tennis ball falls would be different if it were dropped in an atmosphere of argon, which is denser and has a larger drag coefficient than air. You should refer to upthrust and to the equation $D = ½ \rho A C_d v^2$ in your answer.

....

....

....

....

....

.... **[4]**

Question 7(d) should be compared in its demand with Question 7(b). Question 7(d) is more demanding, as plugging in values into an equation as in 7(b) requires less analytic skill than predicting the effect changes in the variable would produce.

Very few candidates gave completely satisfactory answers to Question 7(d), even though the question pointed towards the two relationships they needed to consider. Although many realised that increases in both ρ and C_d by themselves would result in an increase in the drag D, v as a factor in the calculation (required to earn marking point 3 in the mark scheme) was ignored by virtually everyone.

Exemplar 3 is typical of a better response here, gaining the first, second and fourth marks clearly and in an organised way.

Exemplar 4, on the other hand was typical of a weak response which ignored the instructions to refer to upthrust and the drag equation. This response gained the first marking point only, and that with some Benefit of the Doubt, because the increased upthrust (line 7) had not been linked to the greater density of argon (line 2).

Exemplar 3

The upthrust would be larger since the weight of argon is more due to it's higher density. The drag force would also be larger since the density and drag coefficient are both larger. This would mean that the terminal velocity would be smaller since the cross sectional area doesn't change and the drag force must be equal to the weight take away the upthrust. The ball would reach it's terminal velocity faster since the acceleration remains constant. **[4]**

This is an example of a difficult type of physics question – discussing quantitative changes without calculation. Although not complete, this was a very sound effort.

Exemplar 4

if table tennis balls were dropped is argon with a higher density the velocity would be lower as it would be harder for ball to travel and more kinetic energy would be required to get the ball through the air. The upthrust would be larger than the weight of tennis ball in argon and the drift equation number would increase as argon provides more drag. **[4]**

This exemplar shows lack of clear organisation and does not address the issues to which the candidate had been directed in the question stem.

Section C

Question 8 (a)

8 Lizzie has bought a new lens for her camera. It is marked with the focal length 50 mm (Fig. 8.1).

She wants to measure its focal length as accurately as possible to see if this value is correct.

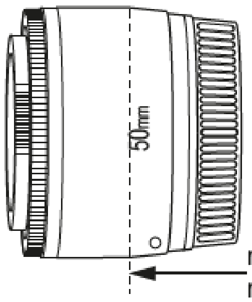


Fig. 8.1

(a) The lens is made up of several different parts fixed inside a plastic case, and Lizzie cannot tell exactly where the centre of the lens is. She decides to make measurements from the top of the '5' as shown.

Lizzie realises that measuring from this point may introduce a systematic error in her data. Explain the term *systematic error* and state how it will affect values of the object distance *u* and the image distance *v* that she obtains.

....

....

....

....

....

....

....

.... **[3]**

Many gave good explanations of systematic error for the first mark here but some just stated that it was due to a fault in the measurement technique without developing that point enough to make it clear. Better responses made it clear than any error in *u* would be pair with an error in *v* of the same magnitude, but few went so far as to say that if *u* were too small, *v* would be too large (and vice versa).

Question 8 (b)

(b) Lizzie uses the arrangement in Fig. 8.2 to measure object (*u*) and image (*v*) distances.

As an object, she marks a black letter **X** on a thin sheet of paper.

The image is formed on a sheet of white card.

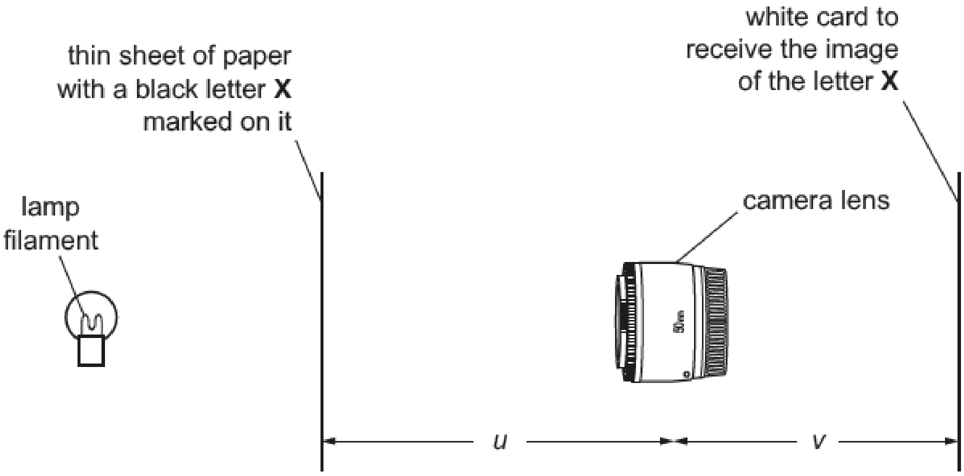


Fig. 8.2

Lizzie finds that a clear image can be seen on the white card over a range of values of *v*. She records this for four repeats at each chosen image position.
Here are her results for *u* = –37 cm.

smallest *v*/cm	34	35	34	36
largest *v*/cm	41	41	40	42

Use these data to find the best estimate of *v* and Δ*v* for *u* = –37 cm.
Explain your working.

v = ... ± .... cm **[2]**

Many candidates over-complicated this part of the question whereas simply finding the mean of all eight values quoted (37.9 cm) and using half the range of the 8 values ([42 – 34]/2 cm = 4 cm) gave 38 ± 4 cm quite rapidly.

Question 8 (c)

(c) Show that the lens equation for a converging lens of power P should result in a straight-line graph with gradient 1 and y-axis intercept P if $\frac{1}{v}$ is plotted on the y-axis for a range of values of $\frac{1}{u}$ on the x-axis.

[2]

Most candidates were familiar with the standard form of a linear relationship (Section 5f of the Specification, Mathematical Requirements, statement M3.3) and were able to transform the equation $\frac{1}{v} = \frac{1}{u} + \frac{1}{f}$ to $\frac{1}{v} = \frac{1}{u} + P$ and then identify *m* and *c* given the required *y*-axis and *x*-axis variables

Question 8 (d)

(d) In her experiment, Lizzie obtains the following set of values of v and Δv for each chosen value of u.

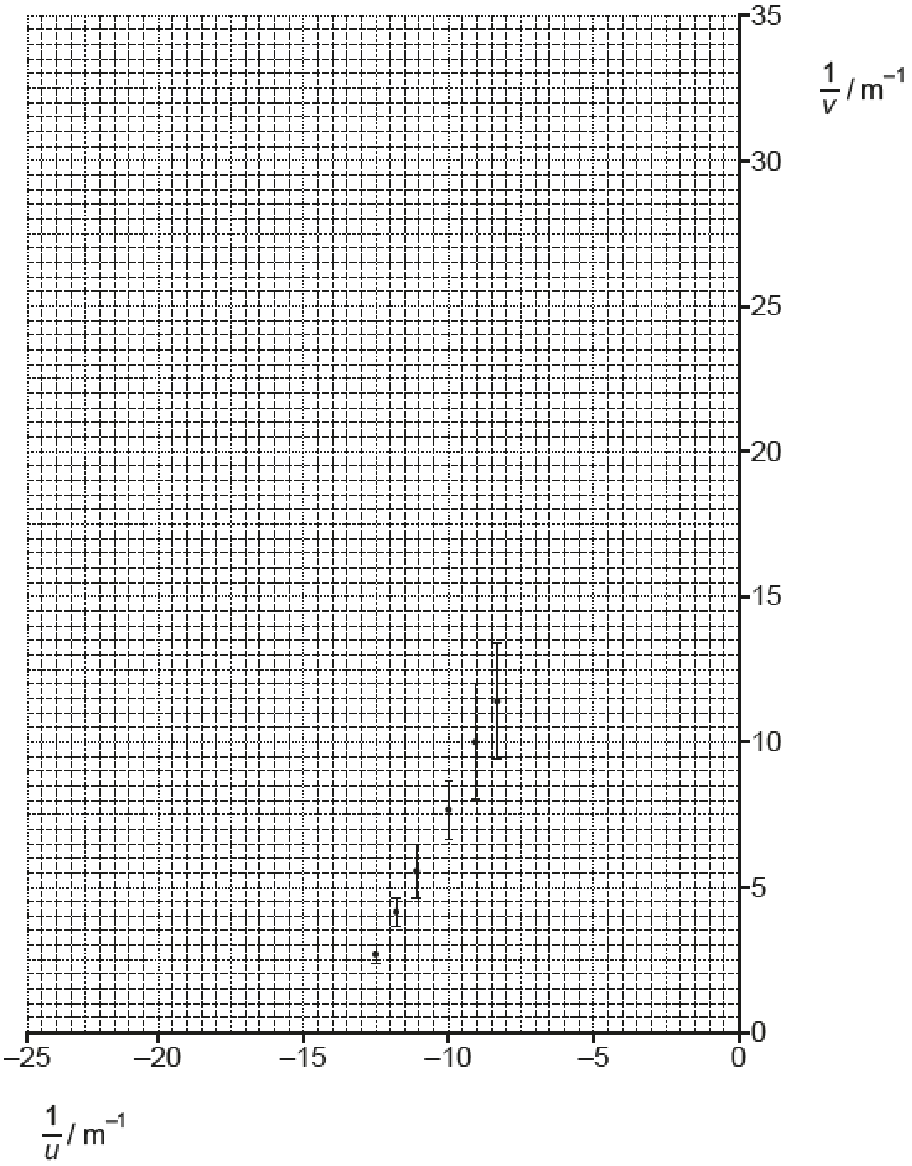
Complete the last two columns and plot the missing data on the graph opposite.

u/m	v/m	Δv/m	$\frac{1}{u}$/m^{-1}	$\frac{1}{v}$/m^{-1}	$\Delta\left(\frac{1}{v}\right)$/m^{-1}
–0.080	0.37	0.04	–12.5	2.70	0.3
–0.085	0.24	0.03	–11.8	4.17	0.5
–0.090	0.18	0.03	–11.1	5.55	0.9
–0.10	0.13	0.02	–10.0	7.69	1
–0.11	0.10	0.02	–9.09	10.0	2
–0.12	0.088	0.01	–8.33	11.4	2
–0.14	0.072	0.008	–7.14		
–0.16	0.063	0.007	–6.25		

[3]

Most candidates correctly calculated the values of $\frac{1}{v}$ but few were successful in finding the uncertainties by using an extreme value of $v + \Delta v$, calculating its reciprocal and subtracting $\frac{1}{v}$. Many did not attempt to plot points, even with uncertainty bars. Candidates often miss actions when asked to do something remote from the request, such as plotting points or adding detail to a graph.

Question 8 (e)



(e)* Use the graph to find the maximum and minimum values of the gradient and the *y*-axis intercept and to evaluate the findings of the experiment. There is lined answer space for your evaluation on the following page. **[6]**

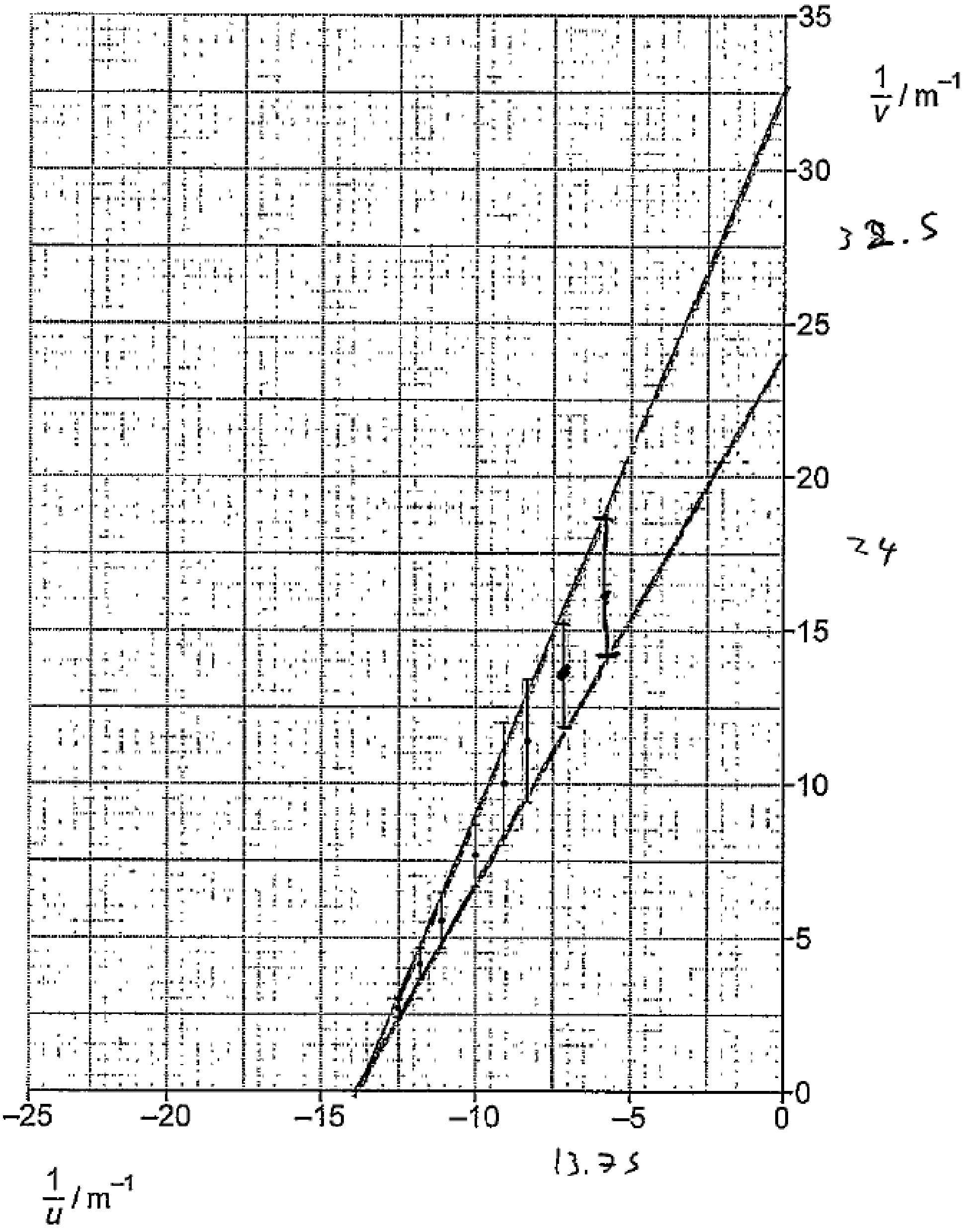
In Question 8(e) candidates were expected to draw the steepest and shallowest possible lines through the data and to find the gradient and intercept for each and to realise, from the information provided in the stem to Question 8(c), that the gradient m should be 1.0 and the intercept 1/50 mm = 20 D.

The graph data results in $1.7 < m < 2.4$ and $24 < c < 33$ which is clearly at variance with the data.

Exemplar 5 made the necessary calculations form the graph (note the good choice of triangles in calculating the gradients!) and clearly linked the differences from the expected values to the experimental procedure. Even though 'the lens was probably closer to the aperture' is not completely clear, this response is a considerable achievement in the dying minutes of the examination and is a clear Level 3, 6 marks.

Exemplar 6 is a typical response from many candidates. The gradients and intercept are well found, but the candidate did not see the logical development inherent in the entire question and did not make any link with the expected values. The faulty definition of 'proportional' in the last sentence was ignored in marking this question. This response is a sound Level 2, so gained 4 marks.

Exemplar 5



(e)* Use the graph to find the maximum and minimum values of the gradient and the *y*-axis intercept and to evaluate the findings of the experiment. There is lined answer space for your evaluation on the following page. **[6]**

minimum gradient $= \frac{24}{13.75} = 1.75$ maximum gradient $= \frac{32.5}{13.25} = 2.36$

minimum y-intercept = 24   maximum y-intercept = 32.5

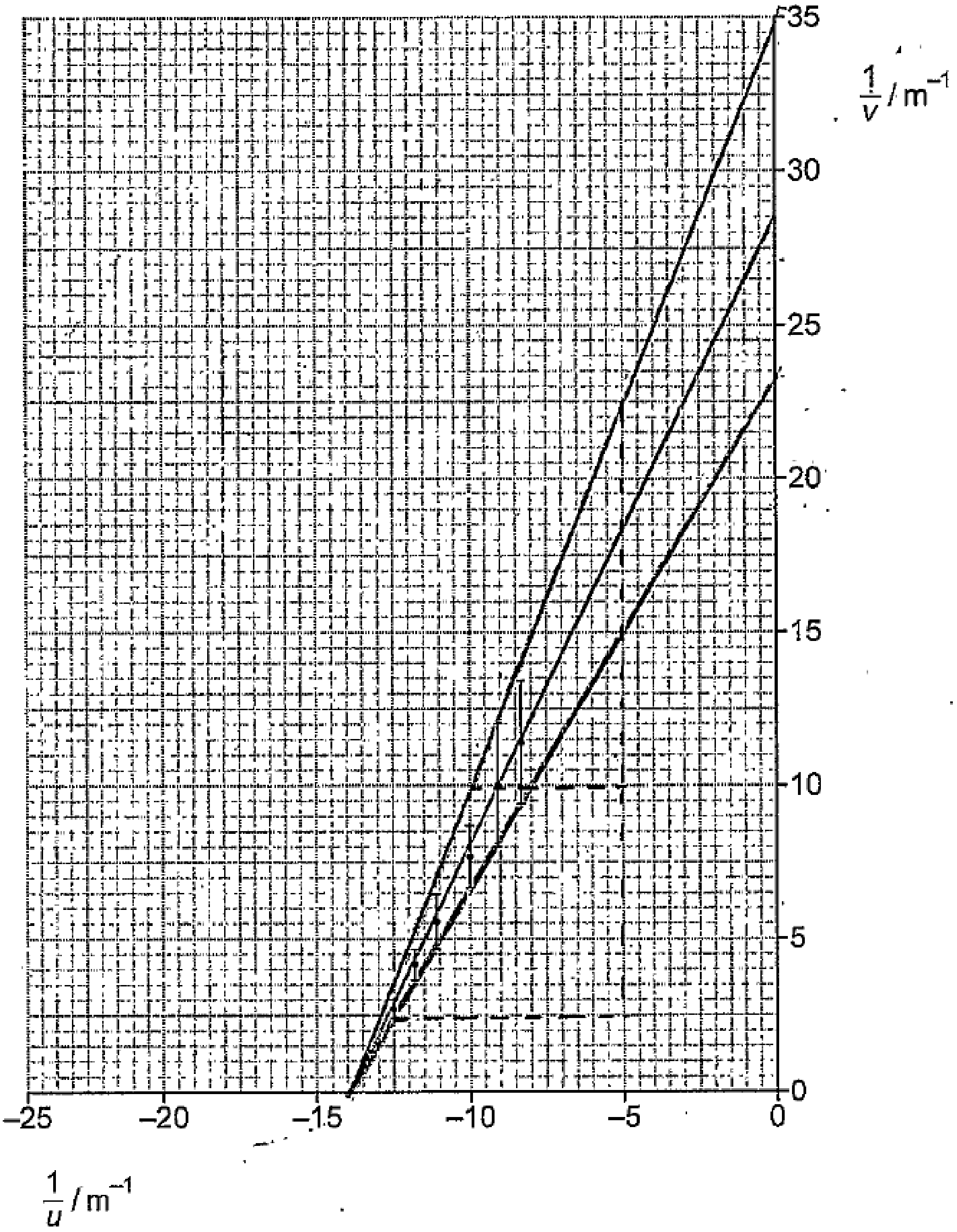
The lens was probably closer to the aperture than Lizzie measured. This would have made values for v larger and u smaller. $\frac{1}{v}$ would be smaller and $\frac{1}{u}$ would be further away from 0. The gradient would have then been smaller and closer to 1 as it should be.

Additional answer space if required

The y-intercept would be closer to 20 since that is the power of the lens. If the experiment was done again, she should measure v and u from closer to the aperture, this would yield more accurate results.

A high-scoring example of the second 6-mark extended response in this paper. Exemplar 5 provides accurate graphical analysis and good evaluation of the experiment. It scored the maximum marks at Level 3, 6/6.

Exemplar 6



(e)* Use the graph to find the maximum and minimum values of the gradient and the *y*-axis intercept and to evaluate the findings of the experiment. There is lined answer space for your evaluation on the following page. **[6]**

max gradient = $\frac{12.5}{5}$

= 2.5

y intercept = 35 m^{-1}

min gradient = $\frac{12.5}{7.5}$

= 1.67

y intercept = 23 m^{-1}

uncertainty = $\frac{5}{28.5} \times 100$

= 17.5

The uncertainty of the experiment is ± 17.5 %, therefore the experiment wasn't very accurate. The gradients vary from 1.67 to 2.5, this is quite a large uncertainty for the experiment. However, it does show that $\frac{1}{u}$ and $\frac{1}{v}$ are proportional as it shows a straight line.

Exemplar 6 provides sound graphical analysis but very limited evaluation of the experiment. It scored the maximum marks at Level 2, 4/6.

Supporting you

For further details of this qualification please visit the subject webpage.

Review of results

If any of your students' results are not as expected, you may wish to consider one of our review of results services. For full information about the options available visit the OCR website. If university places are at stake you may wish to consider priority service 2 reviews of marking which have an earlier deadline to ensure your reviews are processed in time for university applications.

activeresults

Review students' exam performance with our free online results analysis tool. Available for GCSE, A Level and Cambridge Nationals.

It allows you to:

- review and run analysis reports on exam performance
- analyse results at question and/or topic level*
- compare your centre with OCR national averages
- identify trends across the centre
- facilitate effective planning and delivery of courses
- identify areas of the curriculum where students excel or struggle
- help pinpoint strengths and weaknesses of students and teaching departments.

*To find out which reports are available for a specific subject, please visit ocr.org.uk/administration/support-and-tools/active-results/

Find out more at ocr.org.uk/activeresults

CPD Training

Attend one of our popular CPD courses to hear exam feedback directly from a senior assessor or drop in to an online Q&A session.

Please find details for all our courses on the relevant subject page on our website.

www.ocr.org.uk

The small print

OCR Resources: *the small print*

OCR's resources are provided to support the delivery of OCR qualifications, but in no way constitute an endorsed teaching method that is required by OCR. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

This resource may be freely copied and distributed, as long as the OCR logo and this small print remain intact and OCR is acknowledged as the originator of this work.

Our documents are updated over time. Whilst every effort is made to check all documents, there may be contradictions between published support and the specification, therefore please use the information on the latest specification at all times. Where changes are made to specifications these will be indicated within the document, there will be a new version number indicated, and a summary of the changes. If you do notice a discrepancy between the specification and a resource please contact us at: resources.feedback@ocr.org.uk.

Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@ocr.org.uk

Looking for a resource?

There is now a quick and easy search tool to help find **free** resources for your qualification:

www.ocr.org.uk/i-want-to/find-resources/

www.ocr.org.uk

OCR Customer Support Centre

General qualifications

Telephone 01223 553998
Facsimile 01223 552627
Email general.qualifications@ocr.org.uk