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Examiners' Report
January 2013

GCE Physics 6PH07 01

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January 2013

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Introduction

This paper is for international centres and is designed to test practical skills, replacing Unit 6PH03, which is the controlled assessment unit taken by candidates in UK centres.

In order to understand the practical situation, it is important that candidates read the whole question before beginning their responses. This was particularly important in Question 6 but is true for all longer questions. Bullet points are often a good way to structure answers, and a good, labelled drawing can help examiners to interpret candidates' intentions.

It is important that both the question paper and the published mark scheme are read alongside this report.

Question 6 (a)

It was particularly important in this question that candidates had read the whole question before beginning their response. Good answers to this part of the question often focused on the need to drop the cylinder vertically from rest: other relevant techniques are illustrated in the examples below. Less successful answers often mentioned repeating the experiment but did not make it clear why, or that multiple readings should be taken for each position of the light gate.

Good answers like this showed that the candidate understood the context of the experiment and apparatus to be used. This gains two marks.

(a) The student varies the position of the light gate and records t for different values of s.

Suggest what the student should do to obtain accurate values for t.

(2)

① The student must take average values of t for one particular distance, which will compensate any random error.

② The student can check for zero error in the light gate timer.

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Examiner Comments

This answer clearly identifies that multiple readings must be taken for each position of the light gate.

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Examiner Tip

Set your answers out clearly and consider using numbering, as here, or bullet points.

This example also gains two marks.

(a) The student varies the position of the light gate and records t for different values of s.

Suggest what the student should do to obtain accurate values for t.

(2)

The student should repeat the experiment for a specific value of s and ~~diff~~ the time values will be obtained, the student should ~~tt~~ take the mean value of the values of t in that specific value of S. The student have to make sure that the cylinder ~~doesn~~ doesnot touch the wall of the glass tube.

ResultsPlus
Examiner Comments

The candidate has identified two good techniques and the answer is quite specific.

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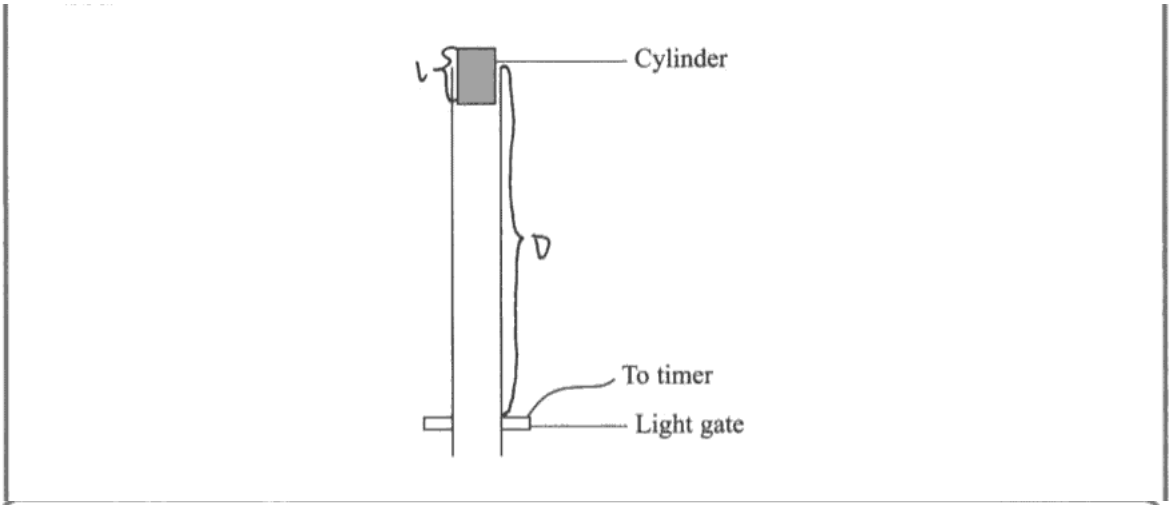
Examiner Tip

For a two-mark answer make sure that you make at least two points.

Question 6 (b)

Successful candidates realised that only one light gate was to be used. They were careful to identify that it was the length of the cylinder that was to be measured. Less successful candidates discussed measuring instruments, which was not what the question had asked.

This candidate has indicated clearly on the diagram the length to be measured and used this in part (ii).



(b) The student needs to determine the velocity v of the cylinder as it passes through the light gate.

(i) State what additional measurement she needs to make. You may add to the diagram if you wish.

(1)

The length of the cylinder, l is needed.

(ii) State how she would use her measurements to calculate v.

(1)

She can get the value of velocity, v by calculating $v = \frac{l}{t}$ (l is the length of the cylinder).

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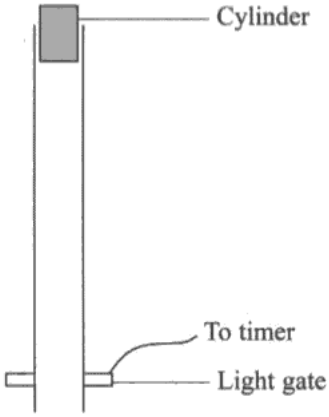
Examiner Comments

This example gained both marks.

This is a very clear answer although the candidate has not made any addition to the diagram.



(b) The student needs to determine the velocity v of the cylinder as it passes through the light gate.

(i) State what additional measurement she needs to make. You may add to the diagram if you wish.

(1)

Measure the length of the cylinder.

(ii) State how she would use her measurements to calculate v.

(1)

velocity = length of the cylinder / time taken for the cylinder to pass through light gate.

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Examiner Comments

This gains two marks.

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Examiner Tip

Remember that you can add to a diagram on the question paper or draw your own to aid your answer.

Question 6 (c)

Successful answers to this question rearranged the required equation in order to compare it with $y = mx + c$. They stated explicitly both that the initial velocity was zero and that as $a = g$ so $2a$ is a constant.

The answer makes it clear that a is a constant and $u = 0$

(c) To determine g, the student uses the equation $v^2 = u^2 + 2as$.

Explain why a graph of v^2 on the y-axis and s on the x-axis should be a straight line through the origin.

(3)

It passes through the origin because when velocity is 0, the cylinder does not move and thus s would also be 0. Also, $v^2 = u^2 + 2as$ when rearranged is $v^2 = 2as + u^2$ and comparing this to $y = mx + c$, v^2 is the y value while $2a$ is the gradient and s is the x value. Since the acceleration is the same and is constant, the gradient too would be constant and thus the graph of v^2 on the y axis and s on the x axis would be a straight line.

ResultsPlus
Examiner Comments
This example gains all three marks.

This example is very clearly set out.

(c) To determine g, the student uses the equation $v^2 = u^2 + 2as$.

Explain why a graph of v^2 on the y-axis and s on the x-axis should be a straight line through the origin.

(3)

$v^2 = (2a)s + u^2$

$\downarrow \quad = \quad \downarrow \quad \downarrow \quad + \quad \downarrow$

$y = mx + c$

The equation is similar to $y = mx + c$, so v^2 against s would produce a straight line with gradient = $2a$ and since initial velocity = 0, $u^2 = 0$ and ~~tis~~ line will pass through origin.

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Examiner Comments

Unfortunately, as the candidate has not stated that *a* is a constant the answer can only gain two marks.

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Examiner Tip

Try to make sure that you make all relevant assumptions explicit.

Question 6 (d)

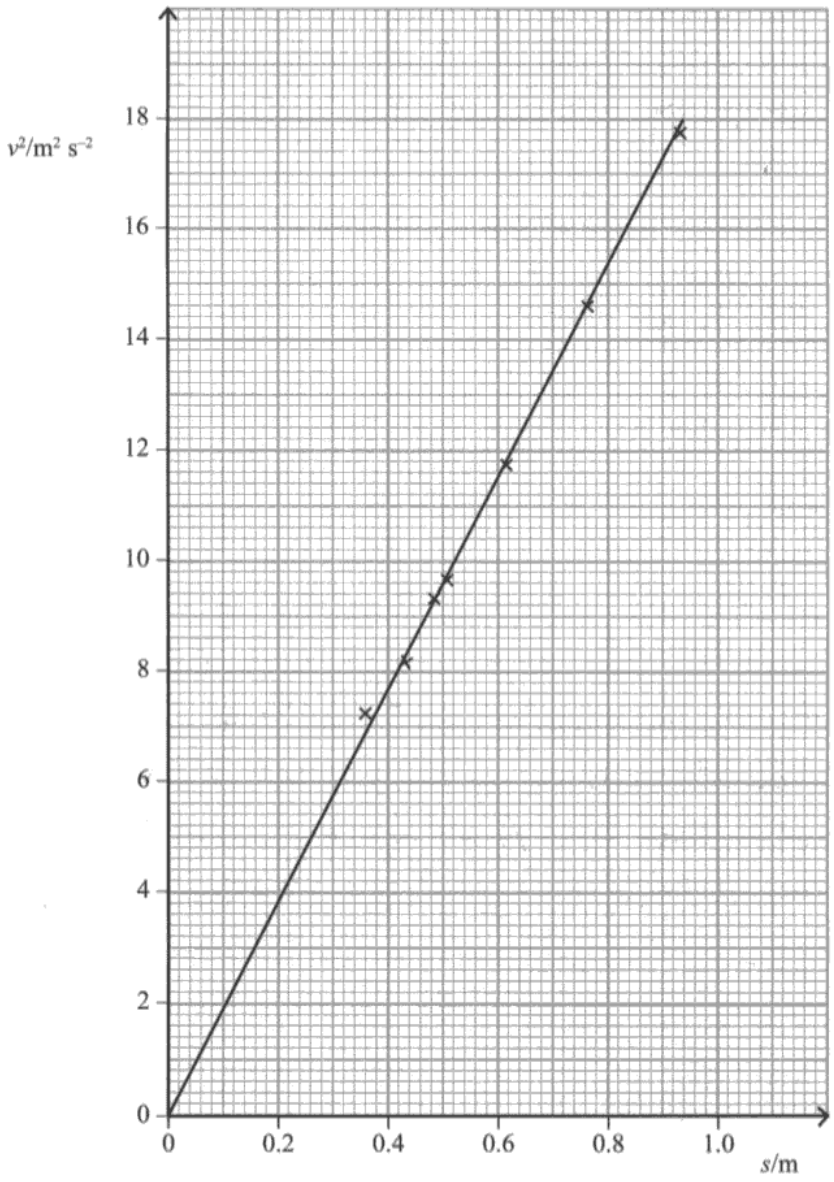
Candidates were expected to use a large triangle for their calculation but not all did.

As this is a practical paper, an appropriate number of significant figures was expected in the final answer: 2 or 3 were accepted.

This candidate has used the whole line for the calculation of gradient.

(d) Use the student's graph below to find a value for g.

(2)



When $V^2 = 18$, and $S = 0.94$ m,

$V^2 = 2aS$

$a = \frac{V^2}{2S} = \frac{18}{2 \times 0.94} = 9.57\ m s^{-2}$

$g =$ 9.57 m s^{-2}

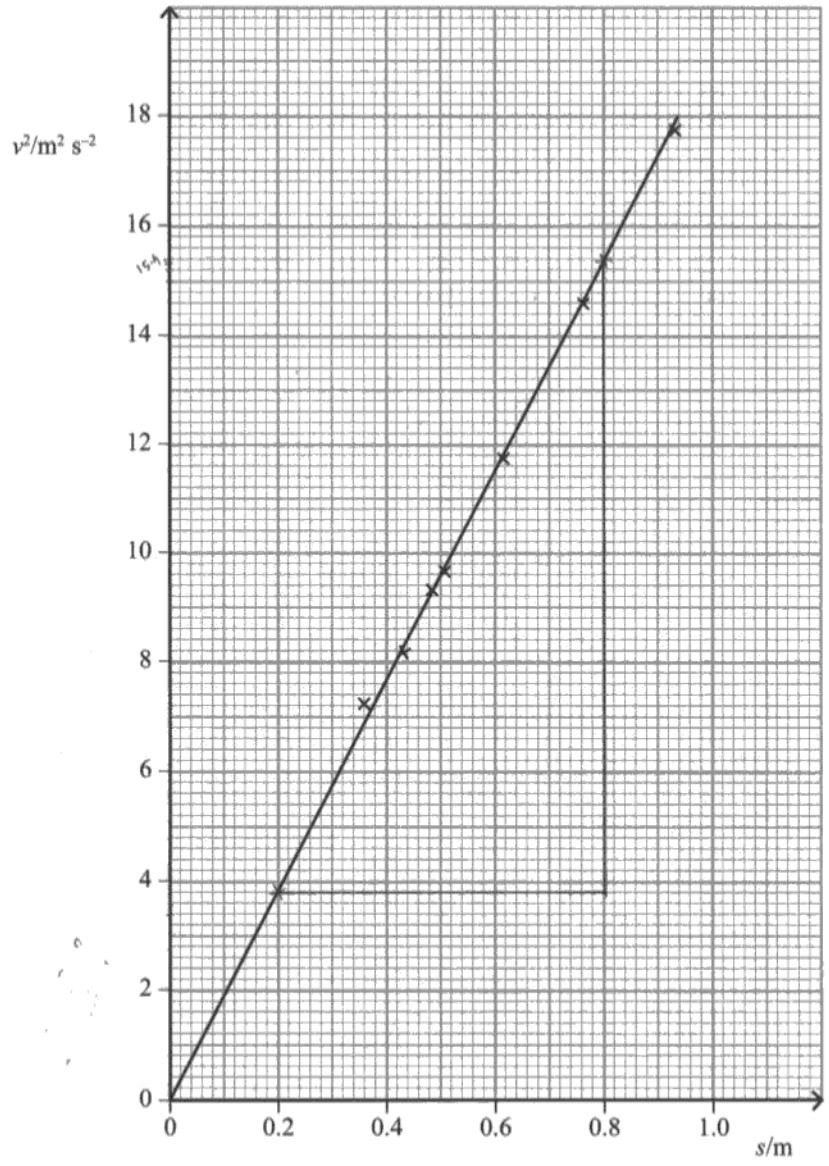
ResultsPlus
Examiner Comments

The candidate's method is clear and the answer gains 2 marks.

Although the origin is a point on the line, this candidate has chosen two points on the line to use to calculate the gradient.

(d) Use the student's graph below to find a value for g.

(2)



$v^2 = u^2 + 2as$

$a = \frac{v^2 - u^2}{2s} = \frac{15.4 - 0}{2 \times 0.8} = \frac{15.4 - 3.8}{2(0.8 - 0.2)} \quad \frac{11.6}{1.2} = 9.67$

$g =$ 9.67 m s^{-2}

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Examiner Comments

This also gains 2 marks, although it is a longer method than in the first example.

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Examiner Tip

Try to use as large a triangle as possible for the calculation of a gradient, and show the triangle you use on the graph.

Question 6 (e)

Candidates were able to gain the mark for this question in a variety of ways. The most correct common answer was that air resistance had been ignored. Answers which discussed parallax, random or unspecified systematic errors were not awarded the mark.

Ignoring air resistance is correctly identified as a possible cause of the low value determined.

(e) The student's value of g is less than the accepted value of 9.81 m s^{-2}.

Suggest why.

(1)

Air resistance may have affected the value.

ResultsPlus
Examiner Comments

This gains one mark.

This is a good answer, which not only gives a cause but also an effect.

(e) The student's value of g is less than the accepted value of 9.81 m s^{-2}.

Suggest why.

(1)

There may be ~~an~~ friction between the cylinder and glass tube reducing ~~?~~ acceleration.

ResultsPlus
Examiner Comments

This scored one mark.

ResultsPlus
Examiner Tip

Always try to justify or explain any assertions made.

Question 7

In planning questions such as this, it is sufficient to give an answer for each of the sections: a method is not required in addition.

Successful answers to this question included a variable resistor in the circuit and suggested ranges for the meters, rather than the scale divisions. As only a low voltage was involved, this was a low risk experiment and marks were not awarded for safety comments, which included goggles or rubber gloves.

This is a good answer, which only lost two marks out of 14. It is clearly set out, and includes a good circuit diagram and a sketch of the graph.

(a) draw a diagram of the circuit to be used and list any additional apparatus that might be required,

(2)

(b) state the quantities to be measured,

(1)

(c) for each of these quantities, state and explain your choice of measuring instrument,

(4)

(d) explain how the data collected will be used to determine the e.m.f. and the internal resistance,

(3)

(e) identify and state how to control all other relevant variables to make it a fair test,

(2)

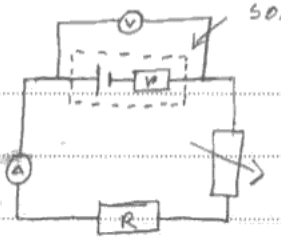
(f) identify the main sources of uncertainty and/or systematic error,

(1)

(g) comment on ~~safety.~~

(1)

a)



solar cell

A lamp is required to power the solar cell

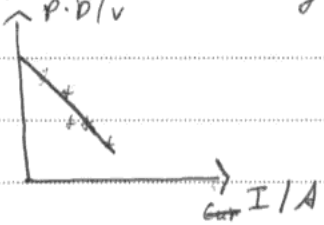
b) The potential difference and the current.

c) The P.D would be measured using a voltmeter reading voltage up to 6 V because the maximum output is 5 V.

The current would be measured using an ammeter reading up to 200 mA because the output current of the solar cell is 100 mA.

d) ~~She~~ The variable resistor will be used to varry the resistance of the circuit and note down its ~~corresponding~~ corrosponding

readings of the voltmeter and the ammeter. A graph will be plotted ~~V in~~ P.D in the y-axis and current in the x axis.



Using the graph and ~~equation~~ equation of terminal voltage the y intercept will be the emf of the cell and the gradient of the graph will give the internal resistance -r'.

e) The lamp will have a fixed power supply so that the solar cell receives the same intensity of light. The voltmeter and the ammeter used should be ideal.

f) The uncertainities will arise due to the ~~system~~ systematic errors of the ~~divices used~~ ammeter and voltmeter used.

g) The experiment carried out is safe because a fixed resistor is being used to prevent # large current from flowing in the circuit.

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Examiner Comments

In part (e), although the candidate has identified the intensity of light as being important, there is no mention of the fact that the distance of the lamp from the cell must be kept constant.

In part (f), *systematic errors* was not sufficient to gain a mark.

ResultsPlus
Examiner Tip

It is important to be specific in answers.

Although this candidate gained 11 marks, neither part (d) nor the answer to section (g) is as clear as in the previous example.

(a) draw a diagram of the circuit to be used and list any additional apparatus that might be required,

(2)

(b) state the quantities to be measured,

(1)

(c) for each of these quantities, state and explain your choice of measuring instrument,

(4)

(d) explain how the data collected will be used to determine the e.m.f. and the internal resistance,

(3)

(e) identify and state how to control all other relevant variables to make it a fair test,

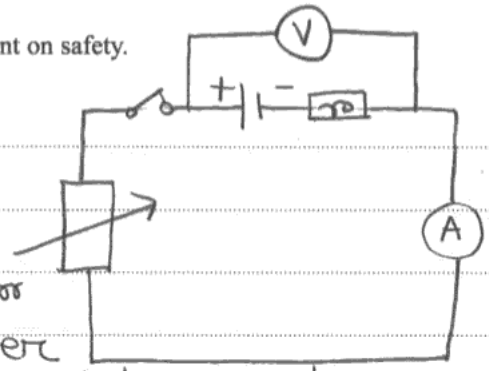
(2)

(f) identify the main sources of uncertainty and/or systematic error,

(1)

(g) comment on safety.

(1)



@ Fixed resistor and Ohmmeter ~~Fixed resistor~~ may be required.

(b). A series of current measurement. And for that, also have to measure some corresponding set of output voltage.

(c). For current measurement, ammeter should be used (0-200) mA. It will give very accurate precision.

For output voltage, voltmeter should be used (0-20)V. It will also give much exact result or value.

(d) A graph will be plotted output voltage against current, after taking a series of current and corresponding voltage reading. The y-intercept of the graph will be the e.m.f of the cell. And, the magnitude of the gradient of the graph will be the internal resistance of the cell.

(e) In every measurement, temperature have to be remain constant to make it a fair ~~fair~~ test. Because temperature can affect the ~~resistant~~ resistance, and, so voltage and current will also alter.

(f) Systemetic error in voltmeter and ammeter reading.

(g) Use gloves, in case if a large current flows and circuit becomes very hot, and, by chance, if it touched the skin, the skin may burn.

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Examiner Comments

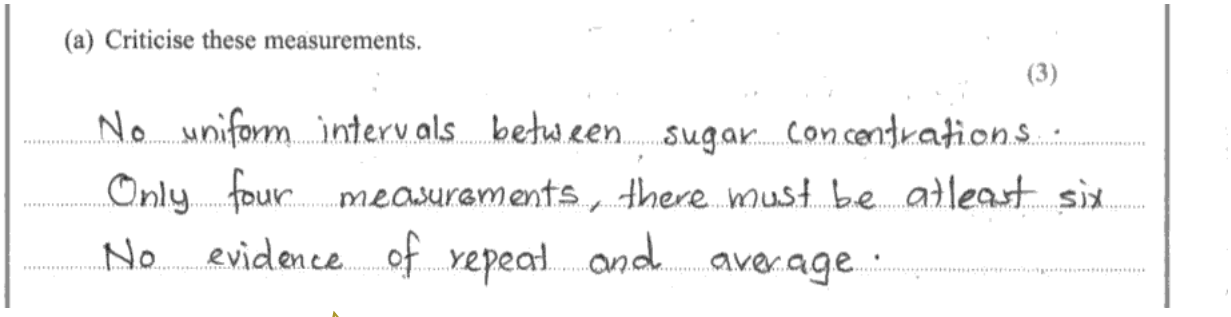
In part (e), keeping the temperature is recognised as a variable to control but no means of controlling it is suggested.

Question 8 (a)

Successful answers to this question were brief and focused on the low number of results shown and the absence of evidence of repeats.

Less successful answers tried to describe the relationship between the variables: this was not what the question had asked.

This gains three marks.



(a) Criticise these measurements.

(3)

No uniform intervals between sugar concentrations.
Only four measurements, there must be atleast six
No evidence of repeat and average.

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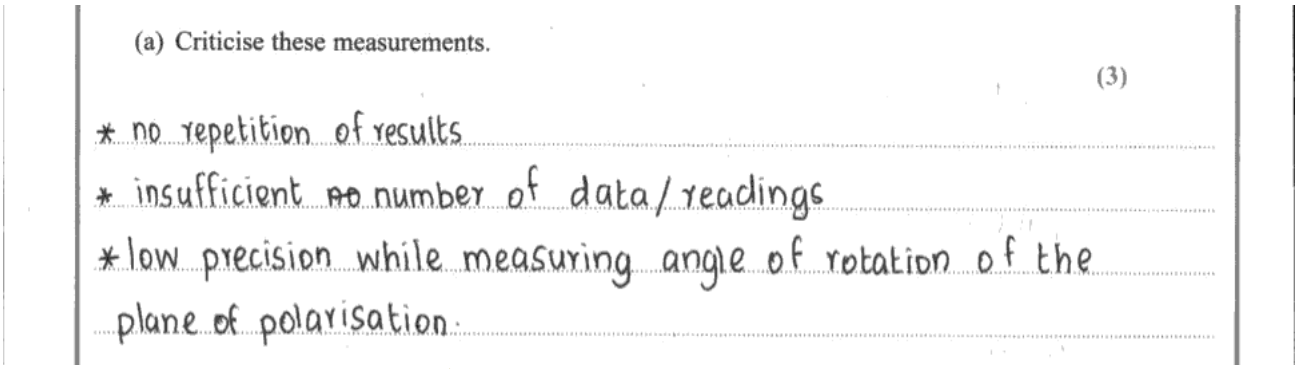
Examiner Comments

The answer clearly identifies three points.

Although this answer is clearly laid out and makes three points, the candidate has not understood that scale readings from protractors are generally only possible to the nearest degree.



(a) Criticise these measurements.

(3)

* no repetition of results
* insufficient ~~no~~ number of data/readings
* low precision while measuring angle of rotation of the plane of polarisation.

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Examiner Comments

This only gains two marks.

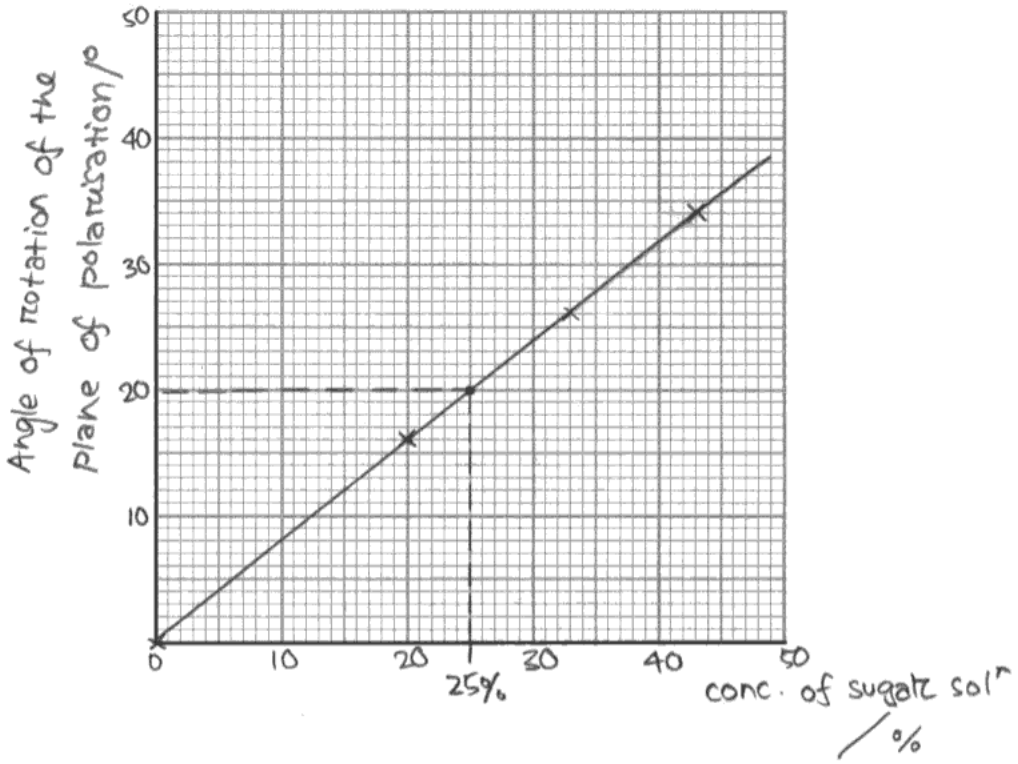
Question 8 (b) (c)

Good answers were seen to this question. Candidates were expected to choose scale divisions which were multiple or sub-multiples of 1, 2 and 5: other values often led to misplotting or misreading.

This is a good graph.

(b) Plot a graph of the angle of rotation of the plane of polarisation against the concentration of sugar solution.

(6)



(c) The students measure the angle of rotation for the unknown concentration of sugar solution as 20°.

Use your graph to determine a value for this concentration.

(2)

20° → 25% sugar solution

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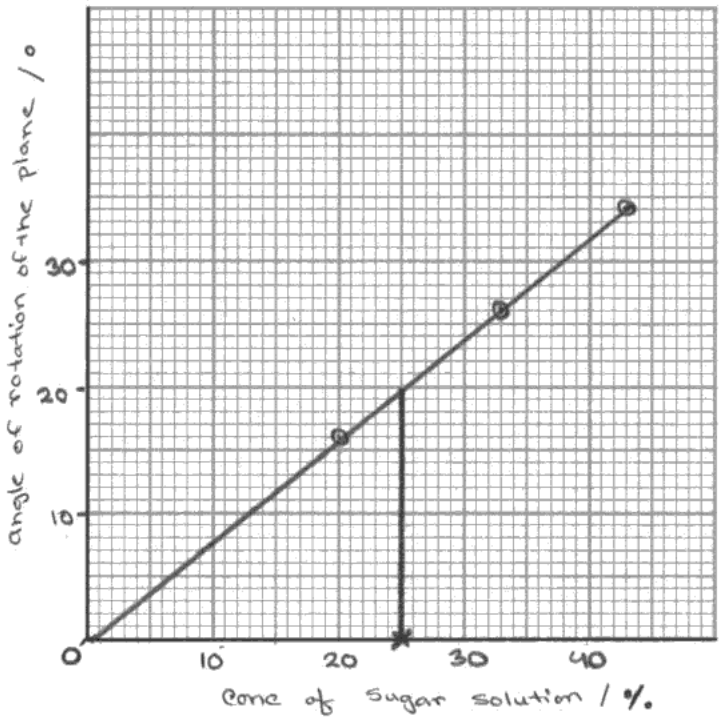
Examiner Comments

Full marks were obtained: 6 for (b) and 2 for (c).

This is another good graph but the candidate has not plotted the origin as a point.

(b) Plot a graph of the angle of rotation of the plane of polarisation against the concentration of sugar solution.

(6)



(c) The students measure the angle of rotation for the unknown concentration of sugar solution as 20°.

Use your graph to determine a value for this concentration.

(2)

Value for the concentration from the graph is 25 %.

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Examiner Comments

This only scores 5 for (b) but 2 for (c).

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Examiner Tip

Remember that (0,0) may be one of the recorded results and, if it is, it should be plotted as a point on your graph.

Paper Summary

It was good to see that graph-plotting skills and the drawing of circuit diagrams appeared to be improving. There were some answers where misunderstanding of the question led to low marks. However, it was clear that many centres are providing candidates with relevant practical skills, as some very good answers were seen.

Based on the performance of candidates on this paper, the following advice is offered.

Future preparation

- Read the Unit 3 specification for coursework and the assessment criteria
- Look at previous examiner reports
- Practise planning and carrying out experiments

Teachers

- Teach candidates how to assess risk and link the identified risks to realistic precautions
- Ensure candidates know how to decide on appropriate numbers of significant figures in practical work
- Encourage candidates to use the number of marks as a guide to the number of points they need to make

Candidates

- Read the whole question before starting your answer
- Consider using bullet points in your answer
- Use a ruler and pencil for graphs and diagrams

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