Let the mind manage the bod
Que l'esprit gère le corps

MAURITIUS
EXAMINATIONS
SYNDICATE

NCE 2020-2021

GRADE 9

Science (Physics)

Subject code: N530

EXAMINERS' REPORT

April 2022

KEY MESSAGES

- There is a need to further develop and consolidate learners' conceptual understanding of basic concepts in Physics. An important number of candidates showed limited understanding of *physical quantities*, *units*, *characteristics of images, reflection* and *refraction* in the assessment 2020-2021.

- It is important to provide learners with sufficient opportunities to carry out hands-on experiments to build their capacity and confidence to respond to inquiry-based questions such as in **Qu. 6**.

- Candidates struggled with the interpretation and plotting of graphs (**Qu. 1 (h)** and **Qu. 5 (c)**). Drawing attention to the use of appropriate scales and building on learners' mathematical understanding of gradient, for example, may help to address this shortcoming.

- Candidates should be encouraged to read questions carefully. Quite often, candidates' answers were irrelevant, imprecise or inconsistent.

- It is worthwhile to draw learners' attention to the following terms used in the Physics assessment paper:

    - *Define / what is* – candidates are expected to provide a formal written statement or sentence.
    - *Explain* – a written relevant comment or explanation on the significance or context of the term(s) used. The number of marks allotted to these types of questions would be indicative of how elaborate the answer is expected to be.
    - *Calculate* – is used when a numerical answer is required. In general, all working should be clearly shown. Candidates are allowed to use calculators in the Physics Assessment.
    - *Suggest* – candidates are expected to apply their general knowledge in the 'context' given.

GENERAL COMMENTS

The National Certificate of Education (NCE) Assessment in Science was introduced for the first time in 2021 in the context of the implementation of the Nine Year Continuous Basic Education (NYCBE) Reform.

The NCE Science Assessment comprises three components, namely:

- Biology
- Chemistry
- Physics

This report focuses on the Physics component of the Science Assessment.

The Physics assessment paper aims at measuring learners' acquisition of knowledge and understanding of the Physics concepts learned, as well as the development of application and inquiry skills, at the end of nine years of continuous basic education.

The content of the Physics Assessment is mainly based on the learning outcomes of the *Science Teaching and learning Syllabus* set at Grade 9. It seeks to provide an engaging and meaningful assessment experience to learners so that they feel confident to pursue Science studies in Grade 10 and beyond. In this way, the assessment presents a range of questions, of varying difficulty levels to enable learners of diverse abilities to demonstrate what they know and can do with respect to the learning outcomes and the assessment objectives they are expected to achieve at the end of Grade 9 or Grade 9+.

Physics learners are assessed on the three Assessment Objectives (AOs) shown in Table 1. These are defined in the *Annual Programme for the National Certificate of Education (NCE) Assessment 2020-2021*. This document is published on the website of the MES and can be accessed at *mes.govmu.org*.

Table 1: Weighting of the Assessment Objectives

	Assessment Objective	Weighting (%)
AO1	Knowledge with understanding	45 – 50
AO2	Application	25 - 35
AO3	Scientific Inquiry	20 - 25

It important to note that, in the context of the COVID-19 pandemic and the disruptions it brought to the school calendar, the Physics assessment 2020-2021 was based on a de-loaded Teaching and Learning syllabus. Thus, a few learning outcomes of the syllabus were not assessed in this first edition of the NCE Assessment in Physics, as listed in Table 2.

Table 2: Learning outcomes not assessed in the NCE Physics Assessment 2020-2021

UNIT	LEARNING OUTCOMES NOT ASSESSED
P5: Electricity	• Set up simple parallel circuits. • Measure current using an ammeter. • Measure voltage using a voltmeter. • Define potential difference as the work done per unit charge moved between two points in an electric circuit. • Recall and use the formula W = QV to solve problems.

Performance in the Physics assessment 2020-2021 was satisfactory. The Physics paper carries a total of 50 marks. The mean mark scored by candidates in the paper was 21.20.

Candidates responded to objective-type questions (MCQs, fill-in-the-blanks, labelling) quite well in general. They could recall basic facts, concepts and formulae. However, they had difficulty in responding to questions that required them to apply their knowledge in both familiar and unfamiliar contexts. Candidates' responses to Questions 2 and 4, for example, indicate that many of them only have a shallow understanding of concepts related to *reflection*, *refraction* and *simple electric circuits*.

It is important to highlight that candidates did not always follow the instructions given in the questions. They often put crosses where they were expected to put a tick. Where

candidates were required to do a calculation, presentation of their work tended to be messy. It is important to note that candidates may lose marks when the responses they give are either unclear or is open to interpretation by the examiners. They should be encouraged, therefore, to adhere strictly to instructions given in the questions and to present their work in an appropriate and intelligible manner.

The performance of candidates in the NCE Physics Assessment 2020–2021 highlighted candidates' limited ability to respond to open-ended questions in general. A significant number of candidates have difficulty to communicate and express their ideas in writing.

SPECIFIC COMMENTS

Question 1

Question 1 comprised 10 Multiple-Choice Questions. They assessed learners' knowledge and understanding mainly. The mean mark scored in this question was 5 out of 10.

The best answered items were items (b), (d), (f) and (g). These items required candidates to recall basic facts and concepts.

Performance on items (a), (c), (e) and (i) was below expectations. These items assessed basic concepts in Physics. It was noteworthy that more than half of the candidates were unable to answer these questions.

The least well answered items in this question were items (h) and (j).

Table 3 gives the answers to the items in Qu. 1.

Table 3: Answer key

Item Number	Key	Item Number	Key
(a)	D	(f)	A
(b)	A	(g)	B
(c)	D	(h)	B
(d)	B	(i)	C
(e)	D	(j)	A

Item (a)

Which one of the following is a **physical quantity**?

A Kelvin **B** Kilogram

C Metre **D** Volume

This was a straight forward question which was correctly answered by less than half of the candidates. Many were not able to differentiate between physical quantities and units. It is worth highlighting that a physical quantity is a property that can be measured whereas a unit is used to express the magnitude of the physical quantity measured.

Item (b)

What is the SI unit of **work**?

A joule (J)

B newton (N)

C second (s)

D watt (W)

This question was quite well answered in general. The majority of candidates recognised the joule (A) as the S.I. unit of work.

Item (c)

Fig. 1.1 shows a simple electric circuit.

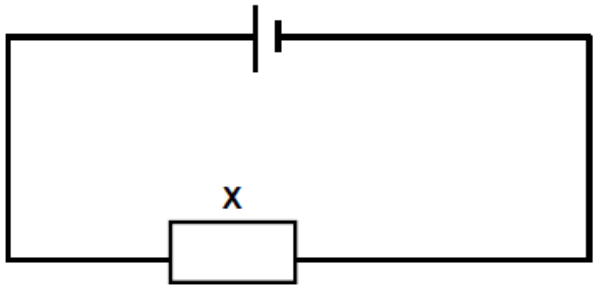


Fig 1.1

What does symbol **X** represent?

A A battery

B A bulb

C A cell

D A resistor

As mentioned above, the performance in this question was below expectation. More than half of the candidates were unable to answer the question successfully. Option 'A' was a popular distractor.

It is important to note that the setting up of simple electric circuits is taught in upper primary. This explains why candidates were expected to show some progress in recognising the circuit symbols used to represent familiar electrical components. Hands-on activities which require learners to set up electric circuits and manipulate electrical components may help to clarify certain misconceptions which they nurture. In addition, requiring learners to draw circuit diagrams that make use of conventional circuit symbols after carrying out the hands-on activities may further build their ability to identify circuit symbols.

Item (d)

Which one of the following is a **vector quantity**?

A Distance

B Displacement

C Speed

D Time

This item was quite well answered on the whole. About two thirds of the candidates were able to correctly identify 'displacement' (B) as a vector quantity. It is encouraging to note that candidates could distinguish vector quantities from scalar quantities.

Item (e)

Fig. 1.2 shows a stretched rubber band.

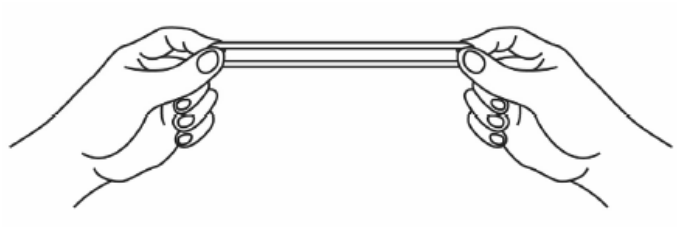


Fig. 1.2

What is the **form** of energy stored in the rubber band?

A Chemical energy

B Heat energy

C Kinetic energy

D Potential energy

About half of the candidates were able to correctly identify 'potential energy' (D) as the form of energy stored in the rubber band. However, a good number of candidates also chose option 'C'. The emphasis on gravitational potential energy as opposed to elastic potential energy in the curriculum may have contributed to the poor performance of candidates on this item.

Item (f)

Which of the following are **non-luminous** bodies?

A Clouds

B Stars

C Glowing fireflies

D Lighted candles

This question was very well answered by the vast majority of candidates. This shows that candidates were able to differentiate between bodies that emit light and those that reflect light.

Item (g)

Fig. 1.3 shows a laboratory thermometer.

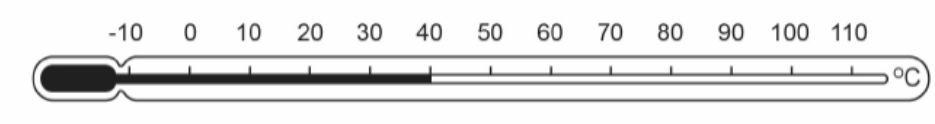


Fig. 1.3

What is the range of temperatures that can be measured using the thermometer?

A from -10 °C to 100 °C

B from -10 °C to 110 °C

C from 0 °C to 110 °C

D from 0 °C to 100 °C

Candidates fared well on this question. This was an application question – *use and interpret numerical and other forms of data*. It is encouraging to note that the large majority of candidates could read and interpret the information given in the diagram.

Item (h)

Fig. 1.4 shows the speed-time graph of a car moving in a straight line.

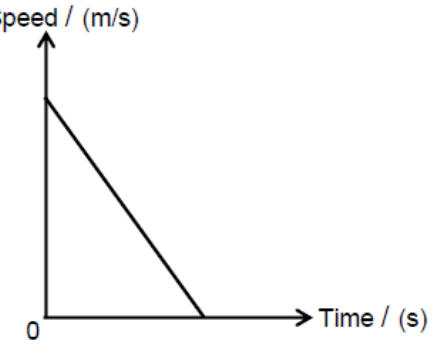


Fig. 1.4

Which statement about the motion of the car is **correct**?

A It is moving with increasing speed.

B It is moving with decreasing speed.

C It is moving with increasing acceleration.

D It is moving with decreasing acceleration.

This item proved difficult on the whole. Many were not able to interpret the speed-time graph. It is important for learners to understand the concept of gradient to be able to respond to such types of questions. There is value, therefore, to build on learners' mathematical knowledge of increasing and decreasing gradients to reinforce their capacity to interpret the speed-time graphs.

Item (i)

This was a straight forward question requiring candidates to recall a most common illustration of refraction in daily life. However, a large number of candidates chose option 'A' instead of option 'C', indicating that the concepts of reflection and refraction are not very well understood.

Fig. 1.5 shows a pencil in a glass of water.

Fig. 1.5

Why does the pencil appear broken?

A Because of the reflection of light

B Because of the absorption of light

C Because of the refraction of light

D Because of the convergence of light

Item (j)

A kettle is switched on for 2 minutes.
The current flowing in the circuit is 10 A.

What is the amount of charge that flows through a given point in the circuit?

A 1200 C

B 20 C

C 5 C

D 0.2 C

Item (j) was the least well-answered item in this series. It assessed candidates' ability to apply their knowledge of how to calculate charge in the given context. A good number of candidates gave option 'B' as answer. It indicates that, in general, candidates were able

to recall the formula Q = It. However, many overlooked that the time had to be converted into seconds before they could apply the formula.

Question 2

Question 2 (a)

(a) Complete the following sentences by using the words in the list given below.

upright **virtual** **right** **lateral** **real**

i) When the man raises his right hand, his left hand appears raised in the plane mirror.

This characteristic of the image is known as _____ inversion. [1]

ii) The image of the man cannot be projected on a screen.

The image is said to be _____ . [1]

iii) The image of the man is also said to be _____ as the head appears at the top and the feet appear at the bottom. [1]

Fill-in-the-blanks questions are generally well done by candidates. However, few candidates answered Qu. 2 (a) correctly. A good number of candidates did not use the words given. Performance on this item showed that candidates had an inadequate understanding of the characteristics of images formed in a plane mirror. It also revealed the reading difficulties faced by many candidates.

Answers: ***(a)(i)*** *lateral,* ***(a)(ii)*** *virtual* ***(a)(iii)*** *upright*

Question 2 (b)

Question 2 (b) was an application question based on a given diagram. Candidates were more successful at answering part (b) (i) than part (b) (ii).

(b) i) How does the **height** of the man in Fig. 2.1 compare to the height of his image in the plane mirror?

Tick (✓) the correct answer.

The height of his image is

☐ **greater** than 170 cm.

☐ **equal** to 170 cm.

☐ **less** than 170 cm.

ii) What is the **distance** between the man and his image in Fig. 2.1?

Tick (✓) the correct answer.

☐ 24 cm ☐ 48 cm ☐ 96 cm

A common mistake made in question 2 (b) (ii) was to choose 48 cm, which was the distance between the man and the mirror. It appears that candidates did not read the question carefully.

Answers: ***(b)(i)*** *equal to 170 cm* ***(b)(ii)*** *96 cm*

Question 2 (c)

(c) Fig. 2.2. shows a ray of light travelling from water into air.
Label parts A, B and C of the ray diagram using the terms given below.

incident ray **angle of refraction** **normal** **angle of incidence** **refracted ray**

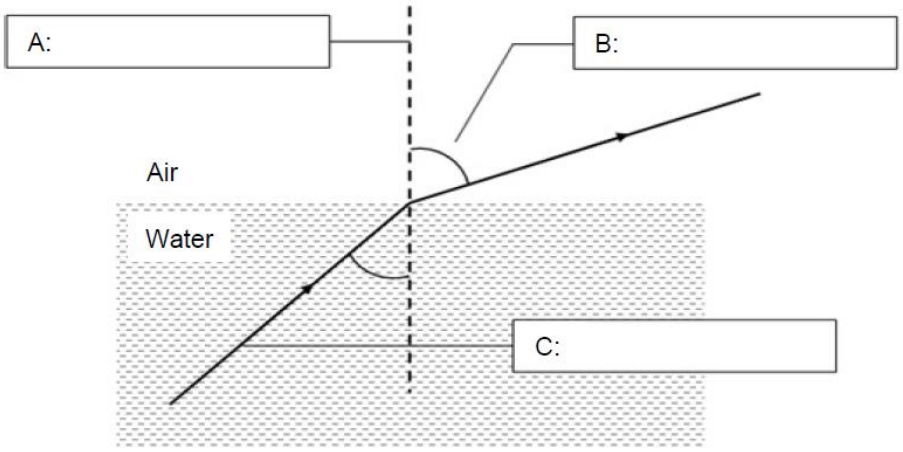


Fig. 2.2 [3]

About a third of the candidates answered this question correctly. Many overlooked the direction of travel of light shown in the figure.

Answers: ***A****: normal,* ***B:*** *angle of refraction,* ***C:*** *incident ray*

Question 3

Performance in Question 3 was satisfactory on the whole. Candidates scored an average of 5 marks out of a total of 7 marks. It is to be noted that the items presented in the question were mostly objective-type questions. This partly accounts for the relatively good performance of candidates.

Question 3 (a) (i)

Table 1 lists different energy sources.

Complete Table 1 to indicate whether the energy sources listed are polluting or non-polluting.

An example is given.

Energy sources	Polluting	Non-polluting
Example: Sunlight		✓
Fossil fuels		
Charcoal		
Wind		

Table 1

[3]

8 out of 10 candidates were able to distinguish between polluting and non-polluting sources of energy, concepts which they have been taught at primary level.

Question 3 (a)(ii)

Give one **disadvantage** of producing electricity in hydro-electric power stations.

_____

_____ [1]

This was the item on which candidates fared least well in Question 3. About one tenth of the candidates were able to score the mark for this item. Often candidates provided answers that were too vague (e.g., **Less electricity is produced*). Advantages of producing electricity in hydro-electric power stations were sometimes given. It shows that some candidates did not pay sufficient attention to the question asked. Answers that

related to insufficient power produced during *droughts* or *when there is water shortages*, the *negative impact hydro-electric power stations have on the environment*, and *the high infrastructural/installation costs involved*, were accepted as correct answers.

Question 3 (b)

(b) A student measures the diameter of a coin using the arrangement shown in Fig. 3.1.

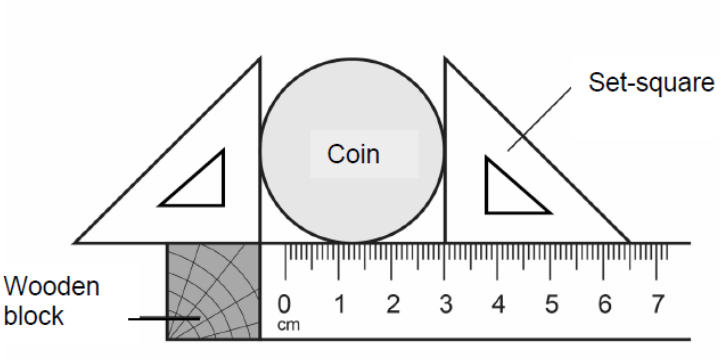


Fig. 3.1

i) The arrangement used by the student is faulty.

What type of error is shown in Fig. 3.1?

_____ [1]

ii) What can the student do to avoid this error?

Tick (✓) the correct answer.

☐ Measure the diameter of 10 coins instead

☐ Place his eyes opposite to the mark being read

☐ Fix the coin between two clearly visible divisions

[1]

iii) Name an instrument that could be used to measure the diameter of the coin more **accurately**.

_____ [1]

Performance on this part question was very good.

In part (b)(i), the majority of candidates correctly identified the error shown as the *zero error*. Thus, most of the candidates were also able to identify what could be done to avoid the error in part (b)(ii). Quite a good number of candidates could identify the Vernier caliper as the instrument that could be used in to measure the diameter of the coin more accurately in part (b)(iii). However, there were many cases where the words 'Vernier' and 'caliper' were misspelt.

Answers: ***(b)(i)*** *zero error,* ***(b)(ii)*** *Fix the coin between two clearly visible divisions*
(b)(iii) *Vernier caliper*

Question 4

Candidates did not do well on this question in general. On average, they scored 3.5 marks out of 11.

Question 4 (a)

(a) Kevin sets up an electric circuit consisting of a 12 V battery, a switch and 2 bulbs, **X** and **Y**.

He connects the two bulbs in series.

Bulb **X** has a resistance of 6 Ω.

Bulb **Y** has a resistance of 2 Ω.

In the space provided below, draw the circuit diagram representing Kevin's electric circuit.

Label your diagram clearly.

The main problem observed regarding this item was the inappropriate use of circuit symbols in drawing the simple circuit diagram. Attention is also drawn to the fact that some candidates represented the resistance of a bulb by drawing both a bulb and a resistor.

Question 4 (b) (i)

(b) i) What is electrical resistance?

_____

_____ [1]

This item assessed the learning outcome: *Demonstrate understanding of current, voltage, emf and resistance*. It assessed candidates' knowledge and understanding of the concept of electrical resistance.

About 2 out of 10 candidates recalled that 'electrical resistance' is the property of a material that opposes or resists the flow of charges through the material. Answers related to electrical resistance as being the ratio of the potential difference across an electric component to the current flowing through it were accepted. Some candidates simply gave the formula R = V/I as their answer. It is important to note that when the terms 'what is' or 'define' is used in a question, examiners expect candidates to write a formal statement that demonstrates their understanding of the concept being assessed.

Question 4 (b) (ii)

ii) Calculate the combined resistance, **R**, of bulbs **X** and **Y**.

Performance on this item was satisfactory.

A good number of candidates calculated the combined resistance correctly. However, an equally good number of candidates indicated that they were unsure about how to find the total resistance. In this way, a diverse range of answers were obtained from either subtracting 2 from 6, by multiplying 2 by 6 or by dividing 6 by 2.

Answer: ***(b)(ii)*** *8* Ω

Question 4 (c)

(c) A bimetallic strip is used in the internal circuit of an electric iron.
Fig. 4.1 A shows the bimetallic strip at room temperature.
Fig. 4.1 B shows the same bimetallic strip after the iron is switched on.

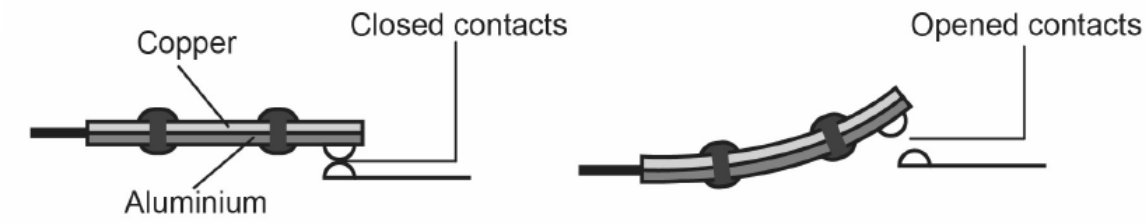


Fig. 4.1A Fig. 4.1B

(i) The sentences below describe how the bimetallic strip functions.
The sentences are **not** in the correct order.
Read the sentences carefully.

A:	The bimetallic strip cools causing the contacts to come together.
B:	The bimetallic strip curves upwards.
C:	The bimetallic strip is heated.
D:	The temperature decreases gradually.
E:	The aluminium strip expands more than the copper strip.
F:	The contacts move apart.

Write the correct order of the sentences in the boxes below.

C					A

This item proved difficult for the majority of candidates.

It shows that candidates in general have not developed a firm understanding of how a bimetallic strip is used to control a thermostat. The stimulus or context used in the question also seemed unfamiliar to candidates.

Few candidates were able to give other examples of appliances which make use of a bimetallic strip in part (ii).

Question 5

This question was not well-answered on the whole. It indicates that the topic on '*Motion*' was not well mastered by learners. On average, candidates scored 3 marks out of 10 on this question.

Question 5 (a)

(a)	A car moving with constant speed along a straight line covers a distance of 200 m in 10 s. Calculate the **speed** of the car.

About three quarter of the candidates successfully answered this part of the question. It assessed candidates' ability to calculate the constant speed of a car, a concept that is introduced in Grade 6.

Answer: *20 mls*

Question 5 (b)

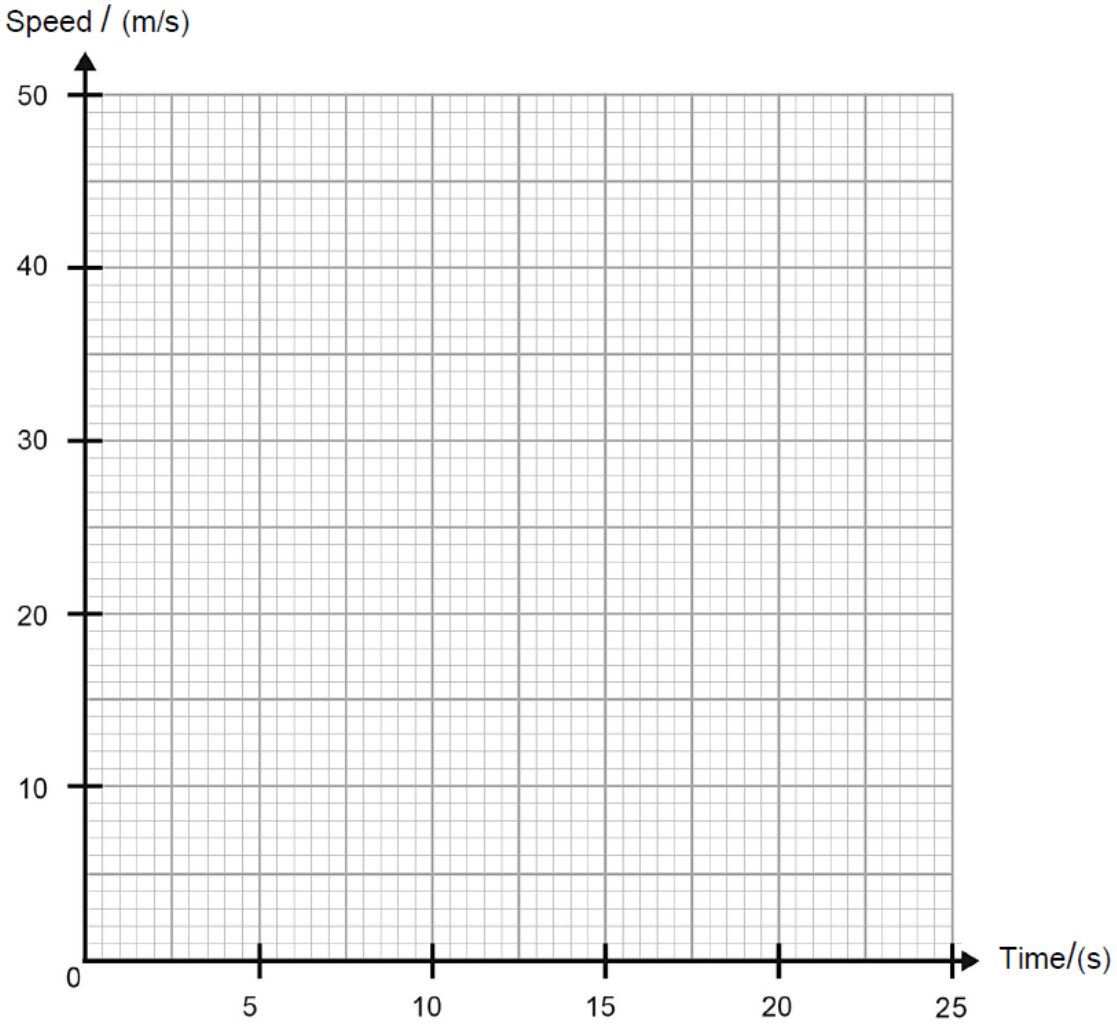
(b)	After 10 s, the car accelerates uniformly to a speed of 44 m/s in 8 s. Calculate the **acceleration** of the car.

A fifth of the candidates could calculate the acceleration in part (b). The large majority of candidates recalled the formula to calculate acceleration, namely $acceleration = \frac{final\ speed - initial\ speed}{time\ taken}$. However, the major difficulty faced by candidates was to acknowledge that the initial speed of the car was the answer they obtained in part (a). Many took the initial speed to be zero instead. This common mistake suggests that learning how to calculate acceleration happened in a mechanical way with, possibly, an emphasis on exercises or examples where the initial speed is zero.

Answer: *3 mls^2*

Question 5 (c)

(c) On the graph given below, plot a speed-time graph to show the motion of the car.



On a positive note, many candidates recognised that constant speed is represented by a horizontal line on a speed-time graph. They also knew that acceleration would be represented by a straight line with positive gradient. However, very few candidates were able to correctly plot the graph using the correct coordinates. Many also had difficulty to interpret the scale on the time axis and were thus unable to plot 18 s correctly on the graph.

Question 5 (d)

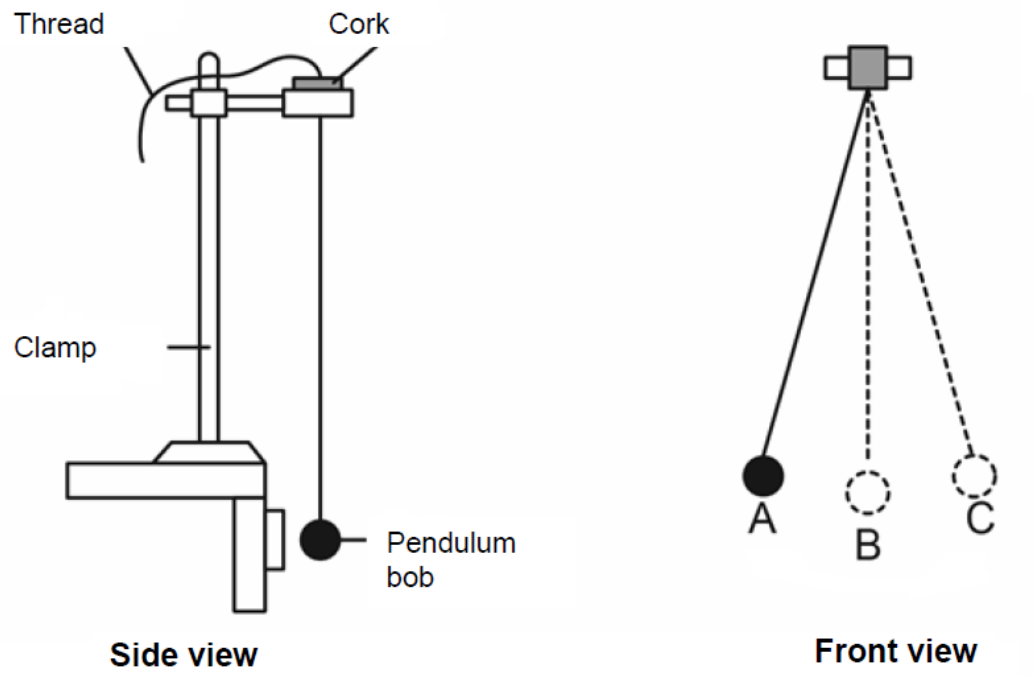
(d) Calculate the distance travelled by the car during the time it **accelerates**.

In this part of the question, candidates generally calculated the total area under the graph overlooking the fact they were required to find the distance travelled during the acceleration. Arithmetic mistakes were common in these cases. Many candidates also used '*distance* = *speed* × *time*' to calculate the distance which was not appropriate. Learners' attention should be drawn to the fact that the formula applies only in cases where speed is constant.

Answer: *256 m*

Question 6

Tina sets up an experiment to determine the time period of a simple pendulum as shown in Fig 6.1 below.



(a) Tina releases the bob from point **A**.

When the bob passes point **B**, she starts the stopwatch and records the time for the bob to complete **one oscillation**.

Describe the path travelled by the bob in completing one oscillation.

(b) i) Give one way how Tina could use the set-up to measure the time period more **accurately**.

ii) Explain how your answer to part (b) i) improves the accuracy of the measured time period.

(c) What will happen to the time period if the length of the pendulum was **increased**?

This question was an inquiry-based question that assessed the scientific skills developed by the candidates. It was successfully answered by only a handful of candidates.

(a) Candidates did not read this question carefully before giving an answer. As a result, many described one complete oscillation as the path travelled by the bob in moving from A to B to C and back to A, neglecting the fact that the stopwatch started as the pendulum bob passed through B.

(b) The major difficulty faced by candidates in this part of the question was to express themselves clearly in writing. The given answers showed that candidates had some understanding of how to measure the time period more accurately. Many of these answers were related to measuring the time for more oscillations. However, these answers were often expressed in an imprecise or inconsistent manner.

Performance in part (ii) suggests that many knew how to calculate the time period from the recorded time and the number of oscillations but, again, candidates were inconsistent in expressing themselves (e.g.,**measure time for 20 oscillations and divide by 10*).

(c) This was the most-well answered part of the question where candidates recognised that increasing the length of the pendulum would cause the time period to decrease.