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

MAURITIUS EXAMINATIONS SYNDICATE

NCE 2023

Science (Physics)

Subject code: N530

EXAMINERS' REPORT

April 2024

INTRODUCTION

The National Certificate of Education (NCE) Assessment in Science was held on 09 October 2023. Candidates from both the Regular Programme and the Extended Programme took part in the assessment.

The NCE Assessment in Science comprises three components namely Biology, Chemistry and Physics. This report highlights the common mistakes and difficulties which candidates encountered in the Physics component of the assessment in Science. The Physics Assessment is mainly based on the learning outcomes of the *Science Teaching and learning Syllabus* set at Grade 9. It aims at gauging the extent to which candidates achieve the three Assessment Objectives (AOs) listed in Table 1.

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

GENERAL COMMENTS

Candidates performed quite well in the Physics Assessment 2023. The Physics question paper was accessible in general. A mean score of 29.3 out of a total of 50 marks was attained. This is the highest mean score that has been achieved since the first session in 2020-2021.

An analysis of candidates' scripts indicates that many were able to answer the objective-type questions successfully. This suggests that a good number of candidates acquired a fairly broad knowledge base of facts in physics. However, there is little evidence that they fully understand the concepts learned. This corroborates with the small number of correct responses obtained to questions that required candidates to apply their knowledge in the given contexts.

It is important to highlight that a good number of candidates do not seem to read the questions carefully before answering them. Others do not seem to read with understanding. While language is not assessed in the Physics Assessment, building students' capacity to read with understanding and to write simple sentences in English will likely help to further improve the performance of candidates in the future.

While the use of calculators is allowed in the Physics paper, it is strongly recommended that candidates show all their workings where required. Partial marks are often lost because of insufficient evidence of how candidates arrived at their final answers.

SPECIFIC COMMENTS

Question 1

Question 1 comprised 10 Multiple-Choice Questions. The performance of candidates in this question was comparable to that in the previous year. Candidates attained nearly 8 out of 10 marks on average in 2023.

Attention is again drawn this year to the fact that some candidates did not encircle the letter corresponding to the correct answer as required. This report, therefore, reiterates the need for candidates to encircle the letter they deem corresponds to the correct answer

when answering Multiple-Choice Questions. In cases where they have to revise their answers and provide another answer, it is recommended that they:

1. cross out the letter encircled.
2. replace their crossed-out answer by encircling a new letter.
3. indicate, using an arrow, the final letter chosen.

An example is shown below.

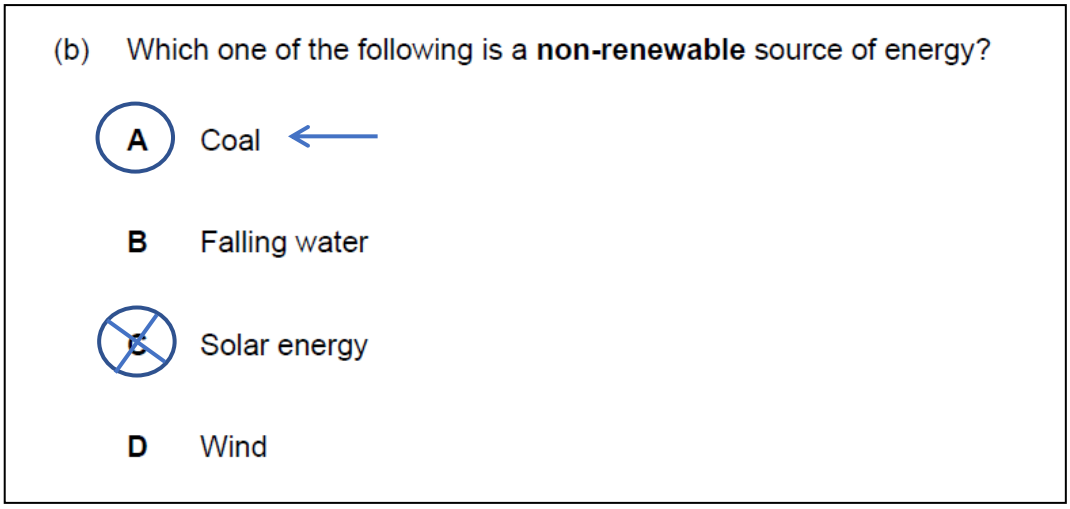


Table 2 lists the answers to the items in Question 1.

Table 2: Answer key to the items in Question 1

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

About 9 out of 10 candidates successfully answered items (a) and (c). These were the most accessible multiple-choice items.

Although about 60 % of the candidates answered these items correctly, items (e), (g), (h) and (i) were among the multiple-choice items on which candidates fared least well.

Item (a)

(a) Which instrument is used to measure **mass**?

A A measuring tape

B An electronic balance

C A stopwatch

D A ruler

This item was the most well answered item in Question 1. Candidates readily recognised the instrument used to measure mass. A handful of candidates, nevertheless, chose option **D**, *A measuring tape, as answer.

Item (b)

(b) Which one of the following is a **non-renewable** source of energy?

A Coal

B Falling water

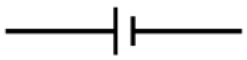
C Solar energy

D Wind

Performance in this question was satisfactory. The concept of renewable and non-renewable sources of energy being taught as early as in upper primary, a larger number of candidates were expected to answer this question correctly.

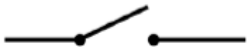
Item (c)

(c) Which electrical symbol represents an **open switch**?

A 

B 

C 

D 

About 9 out of 10 candidates gave the correct answer to this item. It shows that candidates could confidently differentiate between different electrical circuit symbols.

Item (d)

(d) What is the S.I. unit of **length**?

A kelvin (K)

B kilogram (kg)

C metre (m)

D second (s)

Performance on item (d) was comparable to that on item (b). It assessed knowledge of S.I. units of basic quantities. While the majority of the candidates found the correct

answer, fewer candidates were expected to choose option **A**, *kelvin (K). Option **A** was the most popular distractor in this item.

Item (e)

(e) Fig. 1.1 shows a **clinical thermometer**.

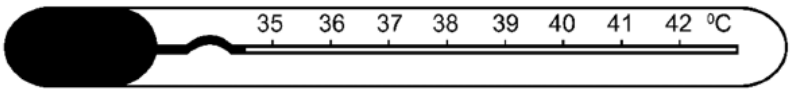


Fig. 1.1

Which temperature can be measured using this thermometer?

A 17 °C

B 27 °C

C 37 °C

D 47 °C

Performance on item (e) was below expectation. It seems that candidates neither paid attention to the embolden term 'clinical thermometer' nor did they read the range of temperatures shown in **Fig. 1.1**. While it may be possible that candidates were not sufficiently acquainted with the range of thermometers, providing students with opportunities to use thermometers in class would likely reinforce their ability to correctly identify the range of different thermometers.

Item (f)

(f) Fig. 1.2 shows an object **P** placed in front of a plane mirror.
Circle the letter which shows the correct position of the image formed.

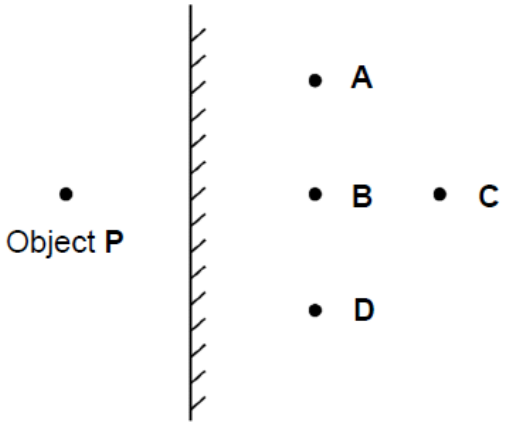


Fig. 1.2

Item (f) was quite accessible to the majority of candidates. The performance in this item could have been even better had there been fewer candidates leaving it unanswered. Students should be encouraged to provide answers to multiple-choice items even when they are unsure or do not know the answer.

Item (g)

(g) Which one of the following is a **vector quantity**?

A Acceleration

B Distance

C Mass

D Speed

About 3 out of 5 candidates correctly identified 'Acceleration' (option **A**) as a vector quantity. Option **B**, *Distance, was the most popular distractor among the incorrect

answers given. As highlighted in previous reports, distinguishing between scalar and vector quantities remains problematic for a good number of candidates.

Item (h)

(h) Which quantity is defined as the **distance travelled per unit time**?

A Acceleration

B Displacement

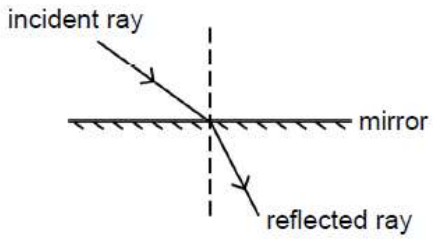
C Speed

D Velocity

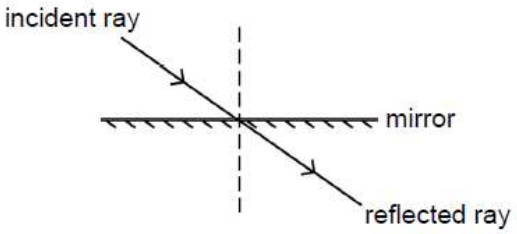
Performance on item (h) was comparable to that on item (g). *Displacement (option **B**) was a powerful distractor in this case. This reinforces the perception that scalar and vector quantities and the topic on *Motion* in general remains quite abstract for a large number of candidates.

Item (i)

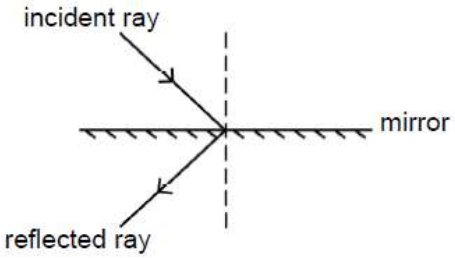
(i) Which one of the following ray diagrams shows the **correct** reflection of light in a plane mirror?



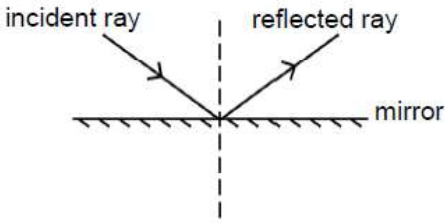
A



B



C



D

This was the least well-answered multiple-choice item. Many seemed to have overlooked the term 'reflection'. The most common mistake was to give answer **A** which showed refraction rather than reflection.

Item (j)

(j) Fig. 1.3 shows a regular pencil.

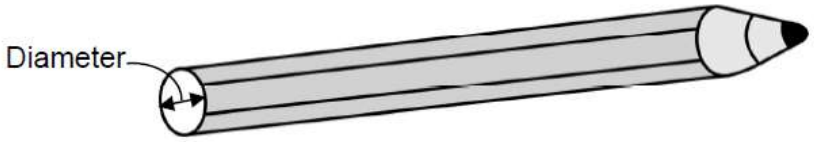


Fig. 1.3

Which one of the following is likely to be the **diameter of the pencil**?

A 6 km

B 6 m

C 6 cm

D 6 mm

As opposed to last year where candidates had difficulties to estimate the speed of an athlete, candidates showed more confidence to estimate the diameter of a pencil. The majority of the candidates could identify '6 mm' (option **D**) as the correct answer. About one fifth of the candidates nevertheless chose option **C**, *6 cm, as answer.

Question 2

Question 2 carried a total of 7 marks. It assessed candidates' ability to identify the different parts of the Vernier caliper as well as their functions. Candidates fared quite well on this question. They obtained a mean score of nearly 5 marks out of 7.

Question 2 (a)

Fig. 2.1 below shows a vernier caliper.

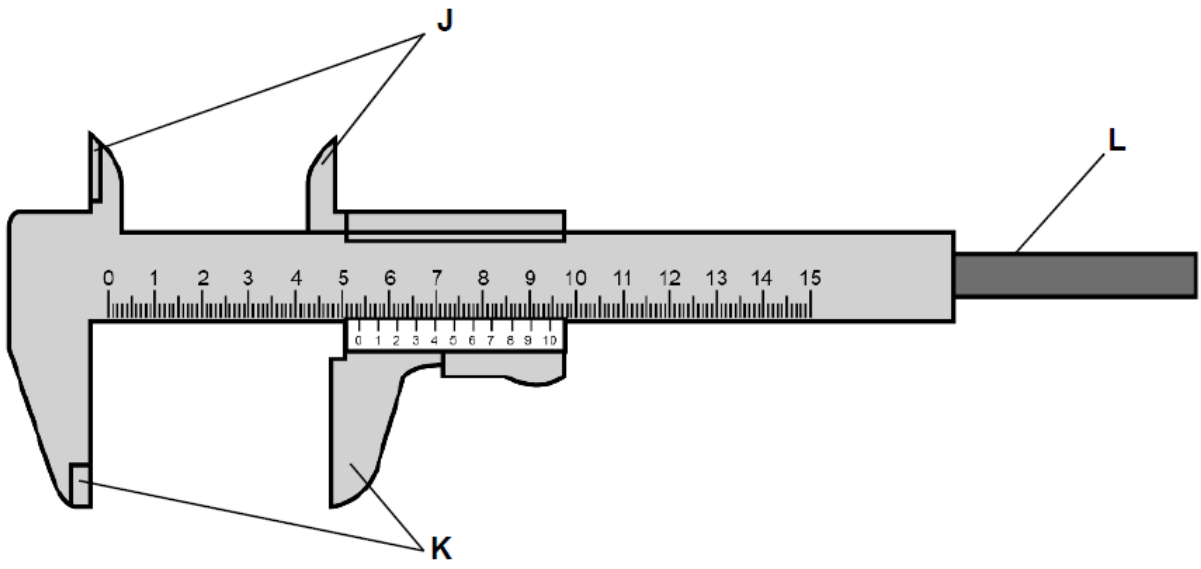


Fig. 2.1

(a) On Fig. 2.1, label the

(i) main scale with the letter **M**.

(ii) vernier scale with the letter **V**.

Qu. 2(a) was well-received by candidates. The majority were able to identify the main scale and the Vernier scale. In some cases, however, candidates did not draw a line alongside their labels **M** and **V**. They simple wrote **M** and **V**. This made it difficult at times

to judge whether the given answers were correct or incorrect. It is important that students be trained to label diagrams properly to avoid the potential loss of marks in the future.

Question 2 (b)

(b) Tick (✓) the correct box.

(i) What is part **J**?

☐ The internal jaws ☐ The external jaws ☐ The tail

(ii) What is part **L**?

☐ The internal jaws ☐ The external jaws ☐ The tail

Question 2(b) was fairly accessible on the whole. The majority of the candidates readily recognised **L** as the tail of the Vernier caliper. However, some candidates were unsure whether **J** represented the internal or external jaws.

Answers: ***(b)(i)*** *The internal jaws* ***(b)(ii)*** *The tail*

Question 2 (c)

(c) Tick (✓) the correct box.

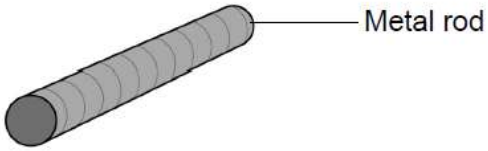
Which part of the vernier caliper should be used to measure

(i) the **diameter** of a metal rod?

☐ **J**

☐ **K**

☐ **L**

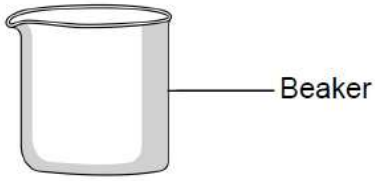


(ii) the **depth** of a beaker?

☐ **J**

☐ **K**

☐ **L**



Candidates' responses to question 2 (c) confirmed the apparent confusion candidates had to distinguish between the internal and external jaws of the Vernier caliper. There were relatively fewer candidates who correctly answered part (i) than part (ii).

Answers: ***(c)(i) K*** ***(b)(ii) L***

Question 2 (d)

(d) Give one type of error that can occur when using a vernier caliper.

..... [1]

Performance in question 2 (d) was satisfactory. In some cases, candidates described the error rather than naming it. The descriptions were accepted when they were sufficiently clear.

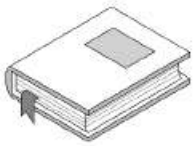
Answers: ***(d)*** *parallax error / zero error*

Question 3

Question 3 was the most well answered question in the paper. It comprised only objective-type questions. Performance in this question was brilliant with candidates scoring a total of 7 out of 8 marks on average.

Question 3 (a)

By putting a tick (✓) in the correct column, classify the objects as luminous or non-luminous.

Objects	Luminous	Non-luminous
 Lighted torch		
 Moon		
 Plane Mirror		
 Sun		
 Book		

Almost all candidates answered this part question successfully. Candidates readily recognised that the lighted torch and the sun were luminous objects. Candidates also easily identified the book as a non-luminous object. A small number of candidates were nevertheless unsure about whether the moon and the plane mirror were non-luminous.

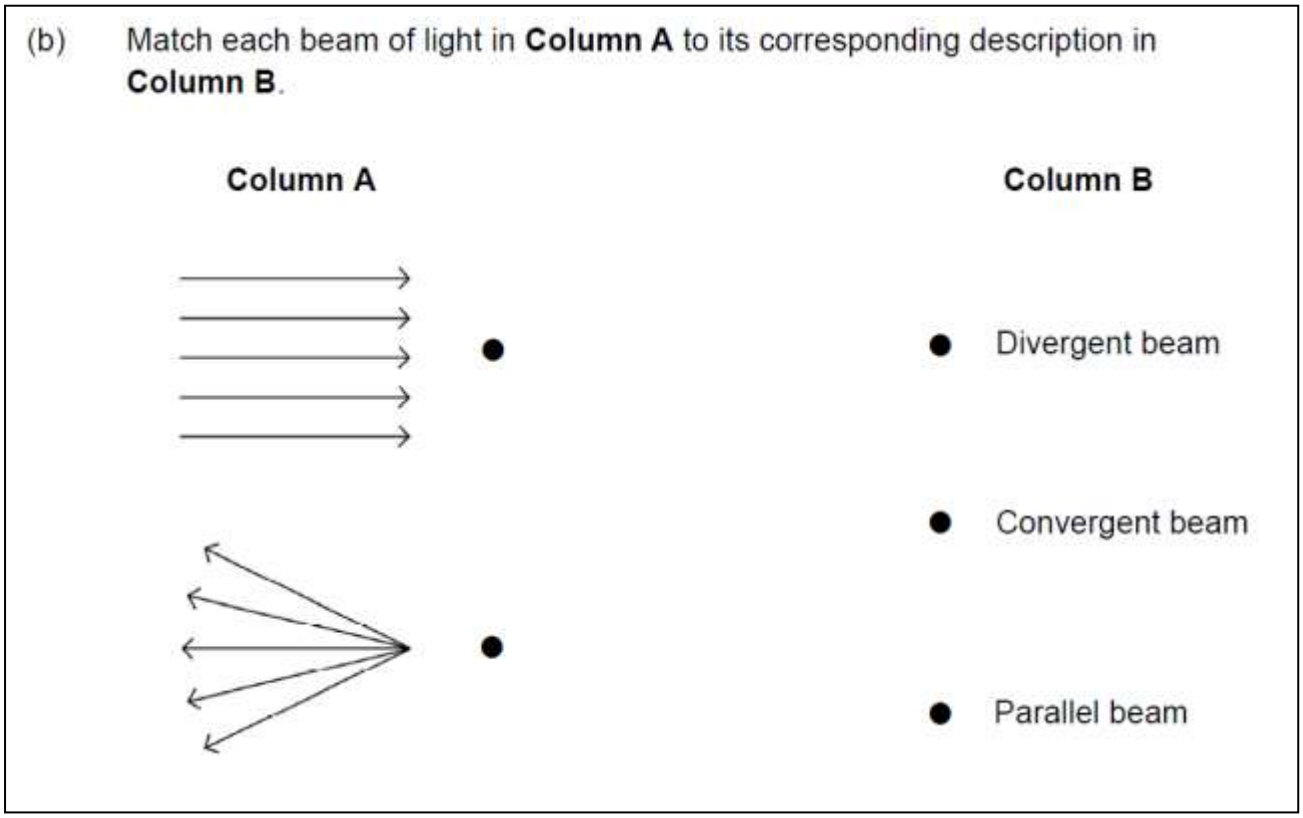
On the whole, candidates' performance in question 3 (a) suggests that the majority of candidates had a good understanding of what luminous/non-luminous objects are.

Answers: ***(a)*** ***Luminous:*** *lighted torch, sun*

Non-luminous: *Moon, Plane mirror, Book*

Question 3 (b)

(b) Match each beam of light in **Column A** to its corresponding description in **Column B**.



Question 3 (b) was straight-forward for the majority of candidates. A few incorrect answers arose from mistaking the divergent beam for a convergent beam of light. The difference between the two is very subtle. It might help to highlight in class that the direction of the arrows representing the rays of light provides a clue as to whether they constitute a divergent or convergent beam of light.

Question 3 (c)

(c) Fig. 3.1 shows a man looking at the light from a candle through a bent flexible paper tube.

Tick (✓) the correct reason why the man cannot see the light from the candle.

☐ Light is reflected.

☐ Light travels in a straight line.

☐ Light is refracted.

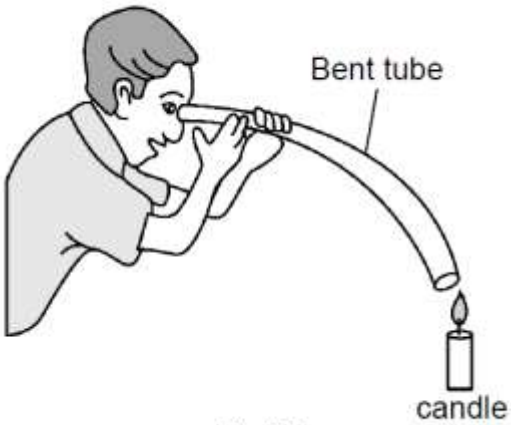


Fig 3.1

This item was successfully answered by the vast majority of candidates. **Fig.3.1** was familiar to candidates and seemed to have helped them make sense of the question. They quite easily recalled that the purpose of the experiment was to show that light travels in a straight line.

Answers: ***(c)*** *Light travels in a straight line*

Question 4

Candidates fared quite well in this question. Out of a total of 7 marks, candidates managed to get 4.64 marks on average.

Question 4 (a)

(a) Fig. 4.1 shows a circuit diagram.

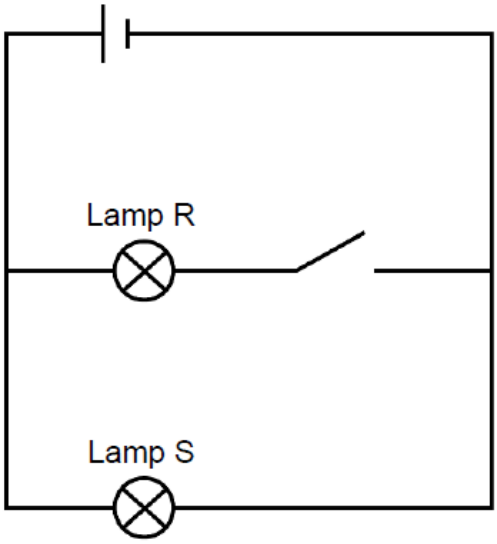


Fig. 4.1

Tick (✓) the appropriate column in the table below to indicate which lamp(s) will light up or not.

Lamp	Will light up	Will not light up
Lamp R		
Lamp S		

In this part question, candidates were required to use their knowledge of complete / incomplete circuits and series / parallel circuits to decide which of the lamps (if any) would light up in the given situation. The majority of the candidates seemed to thoroughly grasp these concepts as most scored full marks.

Answers: ***(a)*** *Lamp R does not light up*

Lamp S lights up

Question 4 (b)

(b) Explain your answer in (a).

.....

.....

Candidates' performance in part (b) was quite good although relatively lower than in part (a). It once again showed candidates' firm understanding of the concepts assessed. It is noteworthy that a greater number of candidates made good attempts at providing an explanation. This is in sharp contrast to last year when candidates simply chose not to attempt such open-ended questions.

Typical answers included:

- *Current does not flow in lamp R*
- *Lamp R is found in an open/incomplete circuit*
- *Current flows only in S where the switch is closed / not open*

Question 4 (c)

(c) An ammeter is used to measure the current flowing in a lamp.

(i) Which electrical circuit in Fig. 4.2 shows the correct position of the ammeter?

Tick (✓) the correct box.

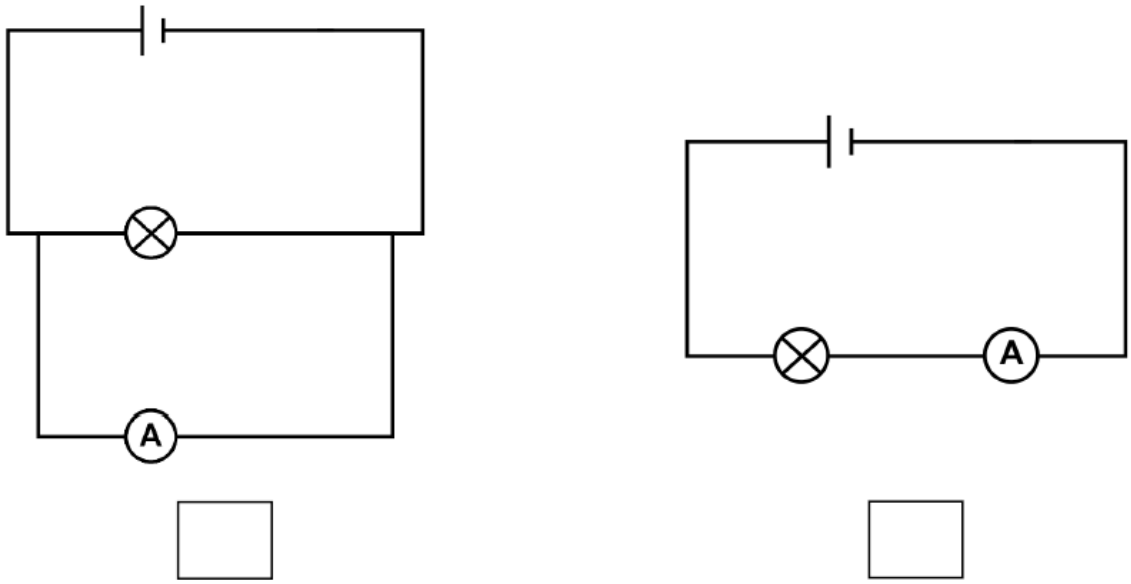


Fig. 4.2

[1]

(ii) Give a reason for your answer in (c)(i).

.....

..... [1]

The majority of candidates knew that the ammeter should be placed in series with the lamp. Two difficulties which most of the candidates encountered were to:

- explain why it should be so.
- use the technical terms such as ‘series arrangement’ and ‘parallel arrangement’ appropriately. Some did not recall the terms and attempted to describe them instead which often led to partly correct and partly incorrect answers for which marks could not be awarded.

Few candidates successfully reasoned that only in a series circuit will the current flowing through the ammeter be the same as that flowing through the lamp.

Typical answers included:

- *The ammeter is always connected in series / cannot be connected in parallel with the lamp to measure the current flowing through it.*
- *In the first circuit, the current flowing through the ammeter is different from the current flowing through the lamp.*

Question 4 (d)

(d) A current of 0.5 A flows in a circuit for 8 seconds.

Calculate the amount of charge that flows in the circuit.
Show all your workings.

Charge flowing = ... C [2]

A good number of candidates answered part (d) correctly. Mistakes usually arose from:

1. using the formula $Q = It$ incorrectly
2. incorrect substitution of the required values when using the formula
3. making arithmetical mistakes.

It is important that students be reminded that the use of calculators is allowed in the NCE Physics Assessment.

Answer: ***(d)*** *4.0 C*

Question 5

Candidates did not fare very well on Question 5. It was a rather long question based on the topic *Energy, Heat and Temperature*. It carried a total of 12 marks. On average, candidates scored a total of 6 marks. Candidates' performance on this question revealed a number of misconceptions that needs to be addressed.

Question 5 (a)

(a) Fig. 5.1 shows 3 different positions (**K**, **L**, **M**) of an apple falling from a tree.

In which position does the apple have **minimum**

(i) potential energy?

..... [1]

(ii) kinetic energy?

..... [1]

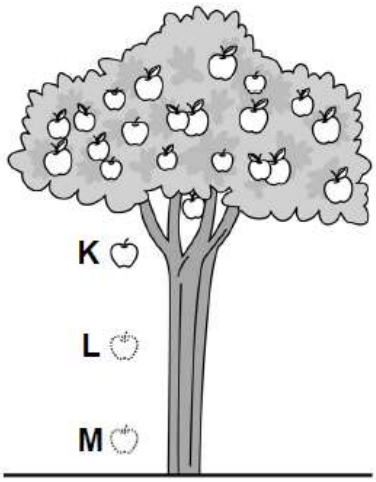


Fig. 5.1

About half of the candidates were able to answer Question 5 (a) correctly. This suggests that a significant number of candidates have a shallow understanding of how the gravitational potential energy is converted into kinetic energy as an object falls, a notion that requires reinforcement in class.

Answers: ***(a)(i) M,*** ***(a)(ii) K***

Question 5 (b)

(b) Fig. 5.2 below shows the different positions of a pendulum bob while it is swinging to and fro between **X** and **Z**.

(i) On Fig. 5.2, draw **two** arrows to show the direction of motion of the bob during one complete oscillation from **X**. [1]

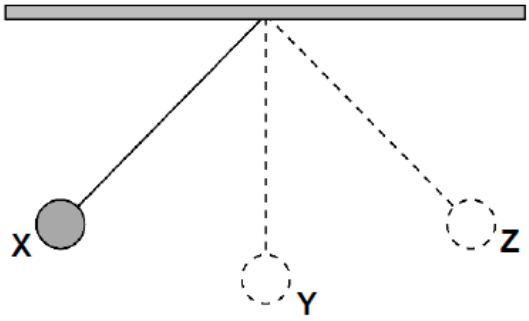


Fig. 5.2

(ii) The pendulum bob makes 40 complete oscillations in 30 seconds.
Calculate the period of the pendulum.

Question 5 (b) was meant to be a scoring question given that it was set in a similar manner as in the textbooks. However, it proved challenging for many. About a third of the candidates answered part (b)(i) correctly. Fewer candidates could answer part (b)(ii) successfully.

In general, many candidates showed they did not fully understand what a complete oscillation is. They were required to draw two arrows. In many cases, candidates drew either a single arrow or more than two arrows. A wide range of incorrect answers were thus obtained with arrows pointing in opposite directions as if pulling the pendulum bob apart. Some drew lines with arrows at both ends that seemed to indicate that the bob vibrated about a fixed point. Other incorrect answers noted were:

- drawing two arrows, one from **X** to **Y** and one from **Y** to **Z**, which showed only half an oscillation;
- drawing two arrows, one from **X** to **Y** and one from **Y** to **X**.

As regards to part (b)(i), the majority of candidates calculated the period incorrectly by dividing the number of oscillations (40) by the time (30 s) instead of calculating 30/40.

Answers: ***(b)(ii)*** *0.75 s*

Question 5 (c)

(c) A glass jar has a metal lid which is too tight to open.

A student tries to open the jar using three different methods, as shown in Fig. 5.3.

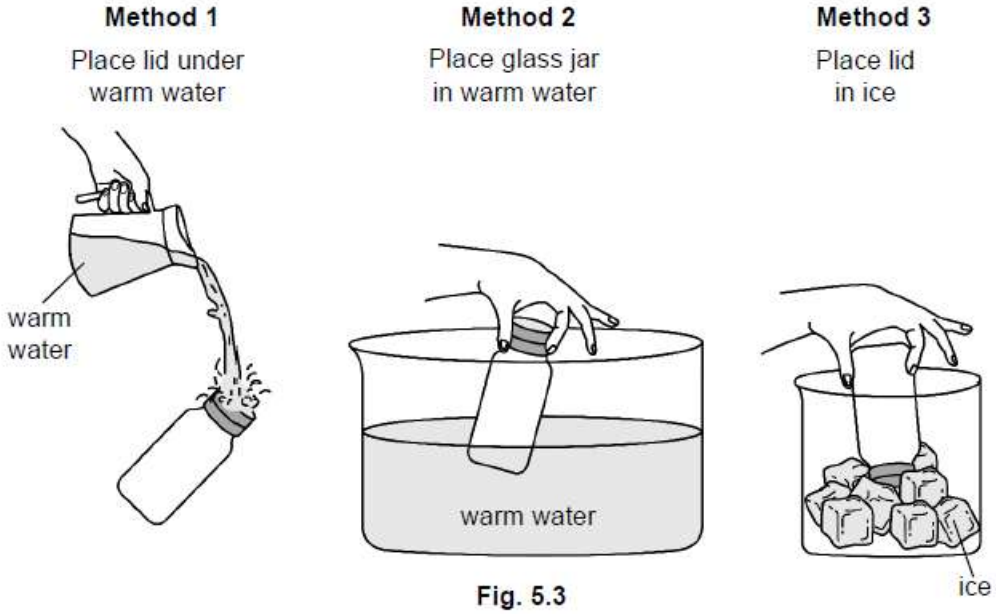


Fig. 5.3

(i) Which method will allow the student to open the lid?

Tick (✓) the correct box.

☐ Method 1

☐ Method 2

☐ Method 3

[1]

(ii) Give a reason for your answer in (c)(i).

.....

..... [1]

A good number of candidates correctly identified ‘Method 1’ as the method that would have allowed the student to open the jar. However, very few candidates could explain why this method was helpful. Candidates’ responses highlighted the persistent difficulty for a large number of them to express their ideas in writing with confidence and clarity.

Answers: ***(c)(i)*** *Method 1,*

(c)(ii) *The warm water helps the lid to expand and to loosen*

Question 5 (d)

(d) The volume of two stones of different sizes is measured using the set-up shown in Fig. 5.4.

(i) Name the method used in Fig. 5.4.

..... [1]

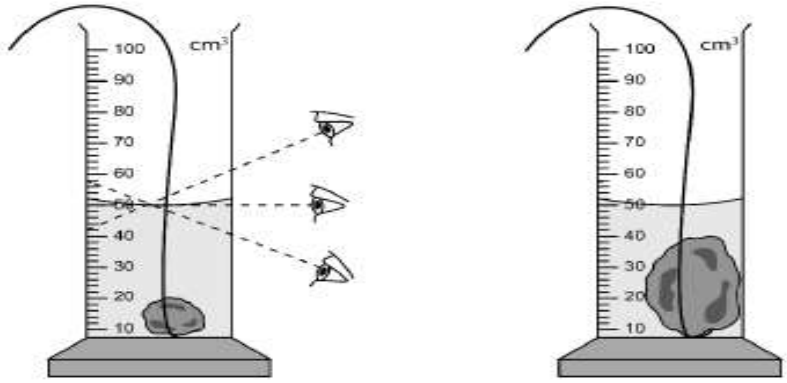


Fig 5.4

(ii) Cylinder **X** and Cylinder **Y** **initially** contained different volumes of water.

After the stones are completely immersed, the level of water in both cylinders is the same.

Which cylinder contained the greater volume of water **at first**?

Tick (✓) the correct box.

☐ Cylinder **X** ☐ Cylinder **Y** [1]

(iii) Give a reason for your answer to (d)(ii).

.....

..... [2]

(iv) On Fig. 5.4, put a tick (✓) beside the correct eye position when reading the volume in cylinder **X**. [1]

A good number of candidates recognised the displacement method in part (d)(i). A common mistake was to write **displacement can* instead.

A fairly good number of candidates were also convinced that Cylinder **X** contained a greater volume of water at first. Often their explanations demonstrated firm understanding of the volume of displaced water being equal to the volume of the stones. However, it is important to point out that often candidates mistook volume – the amount of space occupied by an object – for mass or size. Due consideration should be given to ensure that students do not nurture erroneous ideas about density, mass, size and volume of objects. It is important to draw their attention to the fact that an object, although smaller in size may have a bigger volume by virtue of its mass (considering its density) or that a smaller object is not necessarily lighter than a bigger object.

About 80% of the candidates were able to identify the correct positioning of the eye in part (d)(iv).

Answers: ***(d)(i)*** *Displacement method,* ***(d)(ii)*** *Cylinder* ***X***

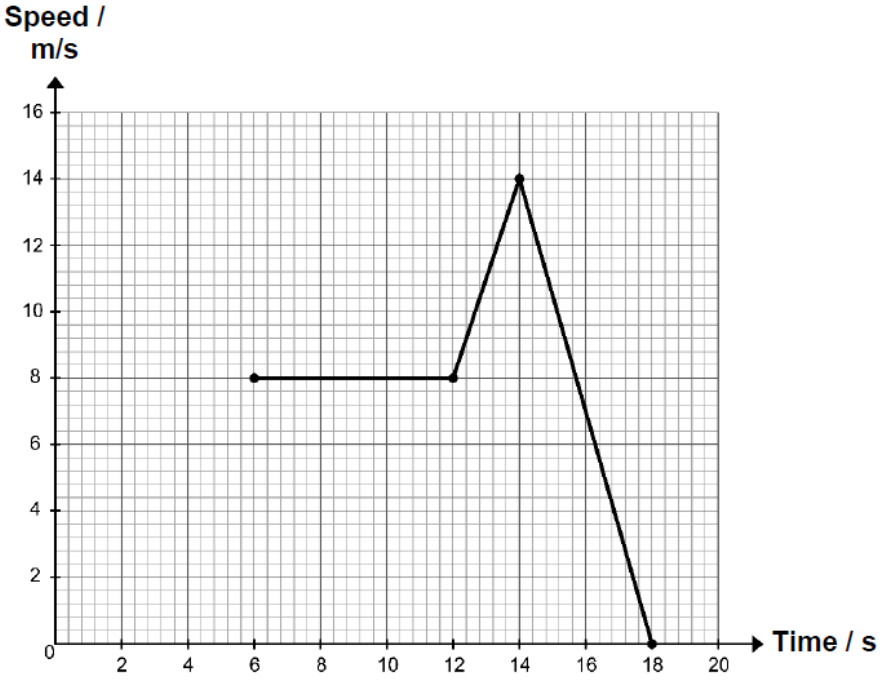
(d)(iii) *The stone in Cylinder* ***X*** *displaces a smaller volume of water than the stone in Cylinder* ***Y****.*

Question 6

Question 6 assessed the topic on '*Motion*'. It carried a total of 6 marks and was the least well-answered question in the paper. Candidates achieved a mean score of 1.89 in the question.

Question 6 (a), (b)

The speed-time graph below shows part of the motion of a car moving along a straight lin



(a) The car accelerates uniformly from **rest** to a speed of 8 m/s **in the first 6 s**.
Complete the speed-time graph to show this acceleration. [1]

(b) For which time interval does the car move with **constant speed**? Tick (✓) the correct box.

☐ 6 s – 12 s ☐ 12 s – 14 s ☐ 14 s – 18 s [1]

Less than half of the candidates could successfully draw the graph showing the required acceleration. A common mistake was for candidates to either overlook that the car accelerated from rest or that they could not interpret *from rest*. Some candidates drew acceleration from the point (0 , 2) – which meant that the car had an initial speed of 2 m/s at t = 0 s. Others drew acceleration starting from the point (2 , 0). And some candidates showed acceleration from the point (6 , 8). Question 6(a) showed that candidates knew how acceleration should look like on the graph. However, plotting the correct coordinates appears to be a challenge for many candidates.

Almost two thirds of the candidates were able to identify the time interval during which the car moved with constant speed.

Answers: ***(b)*** *6 s – 12 s.*

Question 6 (c)

(c) Shade the area under the graph that represents the **distance moved during the deceleration of the car**. [1]

Few candidates successfully answered part (c). Common mistakes were to shade the area under the entire graph or to shade the area under the graph for the time interval 12 s – 18 s.

Question 6 (d)

(d) Calculate the **maximum** acceleration of the car.
Show all your workings.

A handful of candidates were able to answer this part question correctly. As highlighted in the 2021-2022 Examiner's report, calculating acceleration from a speed-time graph (gradient) is problematic for the majority of candidates. Even fewer candidates realised that the part of the graph showing maximum acceleration was during the time the car was actually decelerating. A common mistake was to calculate the acceleration between 12 s and 14 s. Another common mistake was to calculate the acceleration between 0 s and 6 s, 12 s and 14 s and between 14 s and 18 s and to add them up together instead of comparing their magnitudes to identify which one was the greatest.

Answers: ***(c)(i)*** *60 m/s,* ***(c)(ii)*** *0 m/s^2*

(d) *3.5 m/s^2 (magnitude only)*