higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE

(First paper)

NQF LEVEL 2

(10021002)

23 November 2022 (Y-paper)
13:00–16:00

Nonprogrammable calculators and drawing instruments may be used.

This question paper consists of 10 pages and 1 formula sheet.

567Q1N2223

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TIME: 3 HOURS
MARKS: 150

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Keep subsections of questions together.
6. All calculations should consist of at least the following THREE steps:
   - Formula used or manipulation thereof
   - Substitution of the given data in formula
   - Answer with the correct SI unit
7. Approximate all final answers accurately to TWO decimal places.
8. Use only a black or blue pen.
9. Write neatly and legibly.

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SECTION A

QUESTION 1

Give ONE term for each of the following descriptions by writing it next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 Force experienced by an object due to gravity of the earth measured in newton

1.2 Measure of how fast an object moves relative to a reference point

1.3 Region of maximum amplitude situated between the adjacent nodes in a vibrating body

1.4 Angle at which a ray refracts 90° to the normal

1.5 Process of preventing magnetic fields from interfering with electrical devices

(5 × 1) **[5]**

QUESTION 2

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–J) next to the question number (2.1–2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	Simple instrument that taps like a drum on a piece of paper and is used for measuring speed, velocity or acceleration	A	electrostatic induction
2.2	Universal force of attraction acting between all matter	B	mechanical
2.3	Charging of one rod by another close by to give a nearby rod a charge of the opposite type	C	seismic wave
2.4	Wave that results from two progressive waves of equal frequency and similar amplitude	D	fuses
2.5	Used in appliances to prevent too much current from flowing through the appliance	E	standing wave
		F	ticker timer
		G	transverse wave
		H	fibre optics
		I	double insulation
		J	gravitational

(5 × 1) **[5]**

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QUESTION 3

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (3.1–3.5) in the ANSWER BOOK.

3.1 A tap uses a wheel-and-axle mechanism to close off the water.

3.2 One of the factors that differentiate vector from scalar quantities is that both have magnitude.

3.3 When a ray of light hits a shiny surface such as a mirror, it bounces back.

3.4 A charge may be induced into an uncharged electroscope without contact with a charged body.

3.5 Alternating current (AC) flows in one direction from a cell or series of cells.

(5 × 2) **[10]**

QUESTION 4

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (4.1–4.5) in the ANSWER BOOK.

4.1 When a point is acted on by two forces in equilibrium, the forces …

A act in the same direction.
B have equal magnitudes and directions.
C act perpendicular to each other.
D have equal magnitude but opposite directions.

4.2 A motorbike moving at speed V has a kinetic energy E.

If the speed of the motorbike increases to 3 V, the kinetic energy will be?

A 9E
B 27E
C 6E
D 3E

4.3 Which ONE of the combinations is the correct order of electromagnetic waves in decreasing wavelength?

A Gamma rays → X-rays → ultraviolet → visible light → infrared → microwave → TV → radio
B Radio → X-rays → ultraviolet → visible light → infrared → microwave → TV → gamma rays → microwave
C Gamma rays → X-rays → ultraviolet → visible light → infrared → microwave → TV → radio
D Radio → TV → microwave → infrared → visible light → ultraviolet → X-ray → gamma rays

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4.4 Which ONE of the following combinations represents good conductors?

A Copper and PVC
B Aluminium and copper
C PVC and aluminium
D Silver and Perspex

4.5 Electric faults cannot be caused by …

A damage to wires such as fraying.
B overloading/having too many appliances connected.
C incorrect wage/getting the appliance wet.
D closed circuit.

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5: MEASUREMENTS

5.1 Write each of the following in scientific notation:

5.1.1 2 000 000 kg

5.1.2 0,34 A

(2 × 1) (2)

5.2 Write each of the following in symbols:

5.2.1 Megapascal

5.2.2 Microampere

5.2.3 Milligram

(3 × 1) (3)

5.3 Name the instrument used to measure each of the following:

5.3.1 30 cm^3 of water accurately

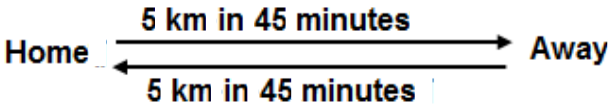
5.3.2 Potential difference across a resistor

(2 × 1) (2)
[7]

QUESTION 6: MOTION

6.1 Define the term *average speed*. (2)

6.2 Donald walks 5 km away from home in 45 minutes. He then turns around and walks back home along the same path, also in 45 minutes.



Calculate:

6.2.1 His average velocity

6.2.2 His average speed

(2 × 3) (6)

6.3 A car runs at a constant speed of 10 m/s for 15 s and then accelerates uniformly to a speed of 25 m/s over 20 s. This speed (25 m/s) is then maintained for another 5 s.

6.3.1 Calculate the acceleration while the speed changes from 10 m/s to 25 m/s. (3)

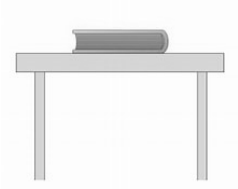
6.3.2 Calculate the total distance travelled in the time described. (5)

6.3.3 Calculate the average speed over the time described. (3)

[19]

QUESTION 7: ENERGY

7.1 A book of 600 g lies on a table as shown below:



7.1.1 Draw the force diagram and clearly show all forces acting on the book. (2)

7.1.2 Calculate the weight of the book. (3)

7.2 Write down the formula of conservation of mechanical energy and state the law. (3)

7.3 A spherical object with a mass of 5 kg is allowed to roll down an incline from point A which is 10 m above the ground.

7.3.1 Calculate the potential energy of the object at point A. (3)

7.3.2 When the object is 4 m above the ground, calculate its velocity. (4)

[15]

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QUESTION 8: MECHANICAL ADVANTAGE

A boy with a mass of 18 kg sits on a seesaw 4 m away from the pivot to the left. His sister is completely in balance with him if she sits on the seesaw 6 m away from the pivot to the right.

8.1 Is this a first-class lever or third-class lever? Give a reason for the answer. (2)

8.2 Draw a diagram of the lever system of this seesaw and clearly show the position of the boy and his sister. (3)

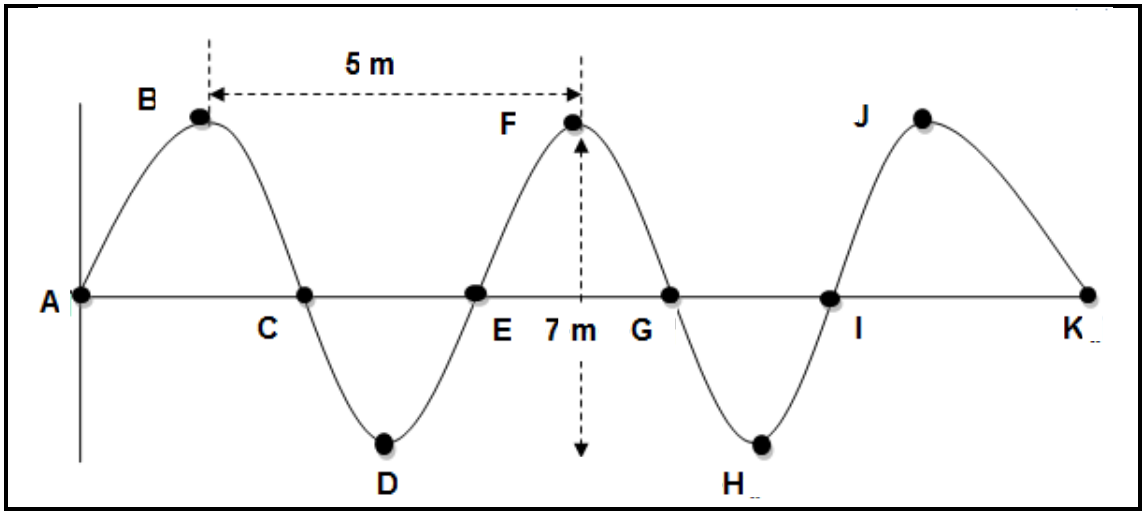
8.3 What is the weight of the boy's sister? (4)

8.4 What is the mechanical advantage of the seesaw for her? (3)

[12]

QUESTION 9: WAVES, SOUND AND LIGHT

9.1 The diagram below represents a water wave moving from left to right. The time between two consecutive crests is 0,4 s. Points A, C, E, G, I and K are in equilibrium position while point B, D, F, H and J represent the crest and trough respectively.



9.1.1 Which type of wave is a water wave? (1)

9.1.2 Define the term *amplitude*. (1)

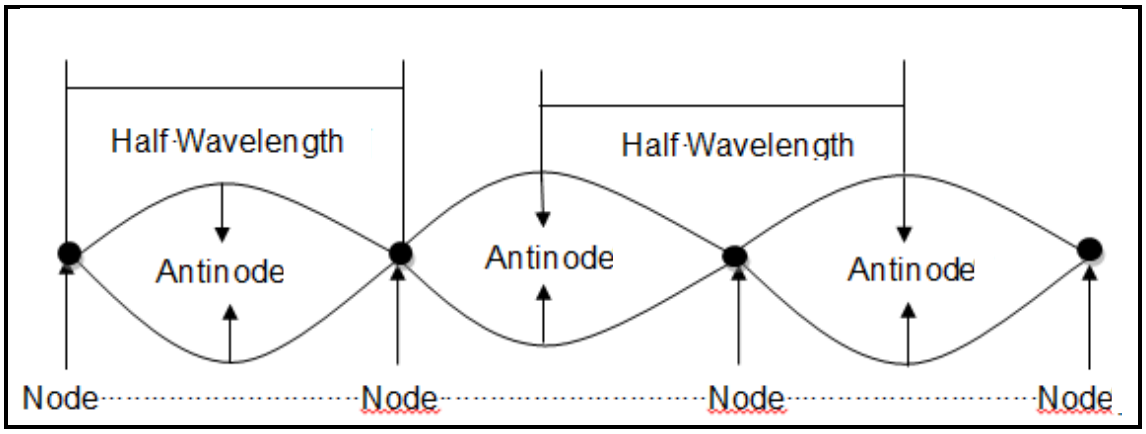
9.1.3 Write down the amplitude of the wave. (2)

9.1.4 How many waves are represented in the diagram? (1)

9.1.5 Calculate the speed of the wave. (4)

9.1.6 Name TWO points that represent the trough. (2)

9.2 Shown below is a stationary wave.



9.2.1 Explain the term *half wavelength* as it relates to the figure. (1)

9.2.2 State which interference occurs at the node and antinode and give a reason for the answer. (4)

9.2.3 Define the term *stationary wave*. (2)

9.3 Cleary draw a ray diagram to show how the image is formed from a plane mirror and give ONE property of the image formed. (5)

9.4 The critical angle for water is 48,8°.

Draw separate diagrams showing the path of light if the angle of incident is:

9.4.1 Less than 48,8°

9.4.2 Equal to 48,8°

9.4.3 Greater than 48,8°

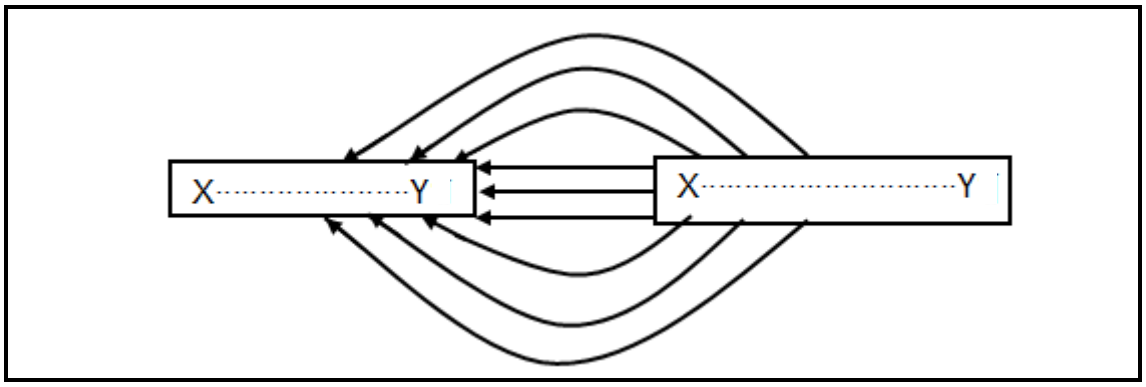
(3 × 2) (6)

9.5 Which ONE of the previous questions represents the total internal reflection? (1)

[30]

QUESTION 10: MAGNETISM

10.1 The magnetic field lines between two magnetic poles (X and Y) of a magnet are shown in the diagram below:



Magnetic force is a noncontact force.

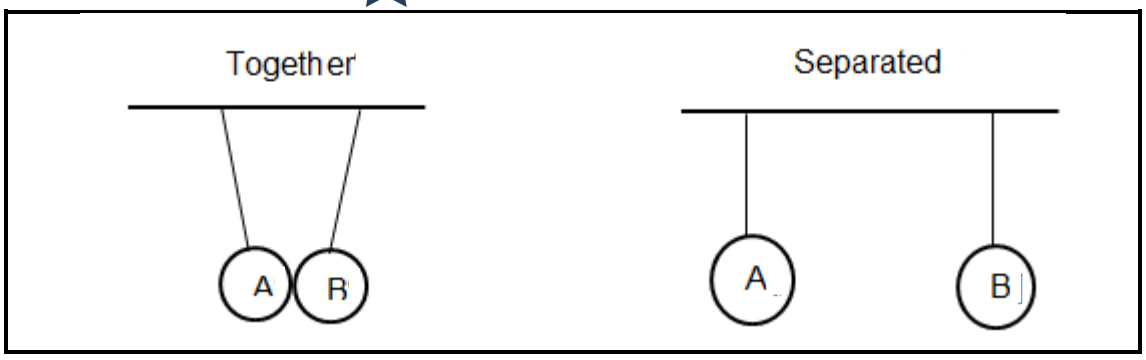
10.1.1 Define the term *noncontact force*. (2)

10.1.2 Give another TWO examples of noncontact forces. (2)

10.1.3 What is the polarity of pole Y? Give a reason for the answer. (3)

10.1.4 What is the nature of the force between the two poles? (1)

10.2 Two charged spheres A and B are brought together to touch and then separated as shown in the diagram below. After toughing and separating, the charge of sphere A is +5 µC.



10.2.1 What is the charge on sphere B after touching if the charge on sphere A was -2 µC before touching? (1)

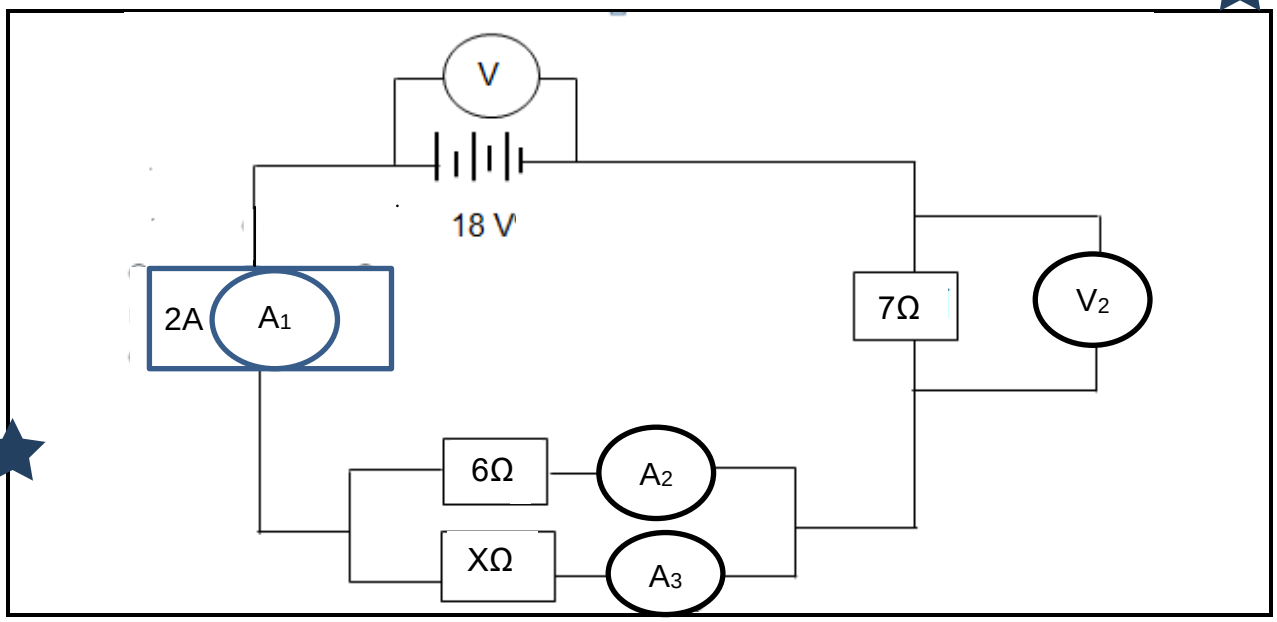
10.2.2 Calculate the initial charge on sphere B. (4)

10.2.3 In which direction did they move (A to B or B to A)? (1)

[14]

QUESTION 11: ELECTRICITY

An electrical circuit consisting of a power-supply voltage of 18 V is connected in series with a resistor R_1 = 7 Ω. The resistor R_1 is also connected in series with two other resistors, R_2 = 6 Ω and R_3 = X Ω, which are connected in parallel with each other. The reading on ammeter A_1 is 2 A and the total resistance of the circuit R_T = 9 Ω.



11.1 Calculate:

11.1.1 The value of X (5)

11.1.2 The voltmeter reading V_2 (2)

11.1.3 And proof that the reading on A_2 and A_3 add up to 2 A (5)

11.1.4 The amount of charge that flows through A_1 in 50 s (2)

11.2 How will the reading on A_1 be affected if X Ω resistor is removed from the circuit? Write only 'Increases', 'Decreases' or 'Remains the same'. (1)

11.3 Explain the answer to QUESTION 11.2 without any calculation. (2)

11.4 Is the given circuit a demonstration of direct current (DC) or alternate current (AC)? (1)

[18]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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FORMULA SHEET

PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m.s^2$
Speed of light in vacuum	c	$3,0 \times 10^8$ $m.s^{-1}$

FORMULAE

MECHANICS

$V = u + at$	$E = ½ mv^2$
$V^2 = u^2 + 2as$	$E = mgh$
$S = ut + ½ at^2$	MA = load/effort
$S = ½(v + u)t$	VR = effort distance/load distance
$F = mg$	$W = F \times S$
	$\eta = (MA/VR) \times 100$

WAVES, SOUND AND LIGHT

$V = f.\lambda$
$T = 1/f$

MAGNETISM AND ELECTRICITY

$R = r_1 + r_2 + r_3$	$Q = It$
$1/R = 1/r_1 + 1/r_2 + 1/r_3$	$E = IR + Ir$
$V = IR$	$V = W/Q$

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