higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(First Paper)
NQF LEVEL 2

(10021002)

28 November 2019 (Y-Paper)
13:00–16:00

A nonprogrammable scientific calculator may be used.

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

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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. Show formulae and substitutions in ALL calculations.
5. Round off ALL final answers to TWO decimal places.
6. Write neatly and legibly.

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SECTION A

QUESTION 1

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

1.1 Single disturbance through a medium

1.2 Ratio between the distance moved by the effort and the distance moved by the load

1.3 Quantity with magnitude but no direction

1.4 Change in direction of light (bending) or other electromagnetic radiation as it passes from one medium into another

1.5 Number of complete cycles or oscillations in one unit time of a vibrating system

(5 × 1) **[5]**

QUESTION 2

Choose an SI unit from COLUMN B that matches a physical quantity in COLUMN A. Write only the letter (A–H) next to the question number (2.1–2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	Length	A	ampere
2.2	Force	B	coulomb
2.3	Acceleration	C	metre
2.4	Potential difference	D	metre per second
2.5	Electric current	E	kilogram
		F	metres per second squared
		G	volt
		H	newton

(5 × 1) **[5]**

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QUESTION 3

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

3.1 Sound waves undergo interference when two waves meet each other.

3.2 The mechanical energy of a falling object is constant.

3.3 When light travels from glass to air its frequency changes.

3.4 Batteries supply alternating current.

3.5 Acceleration is the rate of change of velocity.

(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 An electric toaster is connected across a bulb in a circuit that reads 200 V source for 1 minute. The current in the toaster is 2 A.

The work done in the element of the toaster is …

A 400 J.
B 1 200 J.
C 24 000 J.
D 600 J.

4.2 Sound will be best transmitted by …

A air.
B water.
C iron.
D wood.

4.3 Which ONE of the following statements is FALSE:

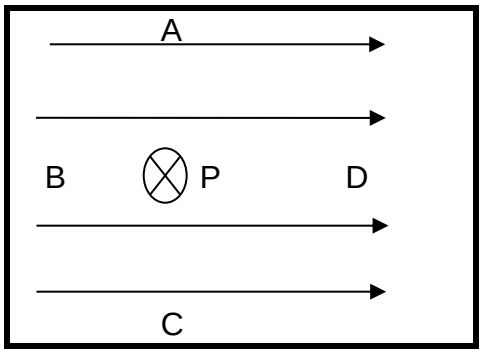
A A convex lens can form real and virtual images.
B A concave lens can only form virtual images.
C A convex lens can enlarge inverted images.
D Images formed by a concave lens are always reduced and inverted.

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4.4 An object becomes positively charged when it …

A loses electrons.
B loses protons.
C gains electrons.
D gains protons.

4.5 The sketch shows a magnetic field. A negative charge moves at point P in a direction perpendicular into a book.



The charge will experience a force in the direction of …

A A

B

C B P D

D C

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5: MEASUREMENTS

5.1 Convert each of the following quantities to the measurement indicated:

5.1.1 2 000 ℓ to m^3 ❄

5.1.2 4,5 km to m

(2 × 1) (2)

5.2 Write each of the following in symbols:

5.2.1 Micrometre ❄

5.2.2 Nanometre

(2 × 1) (2)
[4]

QUESTION 6: MECHANICS

6.1 Distinguish between *distance* and *displacement*. (2 × 2) (4)

6.2 John is on his way to school which is 5 km from his house in an easterly direction. After 1,5 km he drops his watch but only realises that he has done so after walking a further 0,5 km. He turns around to pick up the watch and then carries on walking to school again. His entire journey lasted 40 minutes.

Calculate:

6.2.1 His speed (4)

6.2.2 The velocity of his entire journey (4)

6.3 Rebecca walks through the corridors of her college in the following manner:

40 m east to her classroom
15 m north to the library
10 m west to her locker

6.3.1 Draw a vector diagram which shows Rebecca's motion through the college. (3)

6.3.2 Calculate the total distance Rebecca covers. (3)

6.3.3 Use the diagram in QUESTION 6.3.1 to calculate her final displacement when she reaches her locker. (6)

[24]

QUESTION 7: ENERGY

7.1 State the *law of conservation of energy*. (2)

7.2 A ball of mass 2 kg is held at a height of 1,5 m above the ground and thrown vertically upwards at an initial velocity of 4 $m \cdot s^{-1}$. It reaches its turning point and falls back to the ground. Ignore air resistance.

7.2.1 Calculate the initial kinetic energy of the ball. (3)

7.2.2 Use the energy principles and determine:

(a) The total mechanical energy of the ball at a height of 2 m above the ground (4)

(b) The speed of the ball at a height of 2 m above the ground. (3)

(c) The highest point above the ground that the ball will reach. (3)

(d) The speed of the ball when it hits the ground. (3)

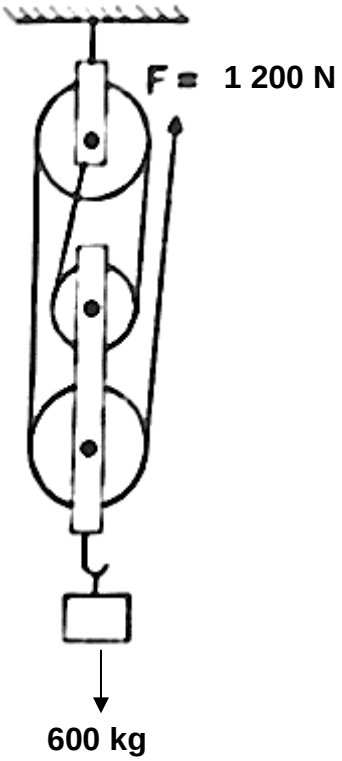
[18]

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QUESTION 8: MECHANICAL ADVANTAGE

8.1 Name THREE types of simple machines. ❄ (3)

8.2 The diagram below shows a single-rope pulley system with ONE movable pulley and TWO fixed pulleys.



❄

Calculate:

8.2.1 The velocity ratio of the machine (2)

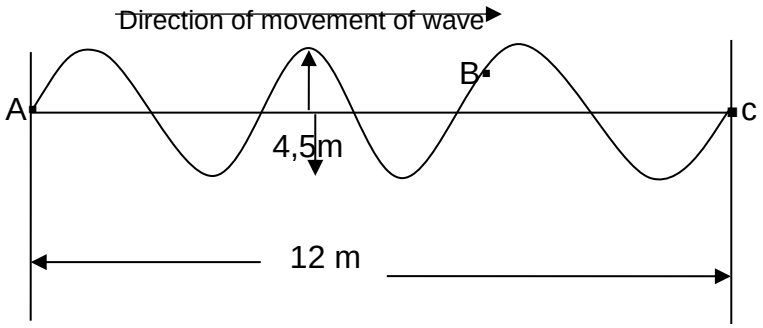
8.2.2 The mechanical advantage of the machine ❄ (3)

8.2.3 The height the load is lifted when the effort moves 4 m (3)

8.2.4 The work done by the load when the effort moves 4 m (4)
[15]

QUESTION 9: WAVES, SOUND AND LIGHT

9.1 The diagram below shows a wave pattern of a wave series with a frequency of 30 Hz.



Calculate:

9.1.1 The time it takes for THREE waves to move from point A to C (2)

9.1.2 The wavelength of the waves (2)

9.1.3 The amplitude of the wave motion (2)

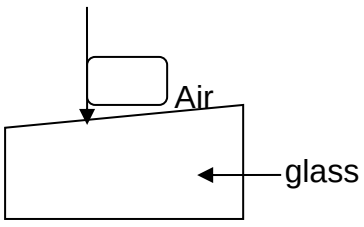
9.1.4 The direction B is moving at this point (2)

9.1.5 The speed of the waves (3)

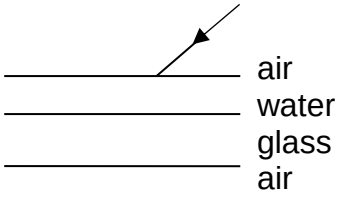
9.2 Draw a neat, labelled diagram that shows the angle of incidence and reflection rays. (6)

9.3 The sketches below illustrate the path of the light rays approaching the interference between water, air and glass.

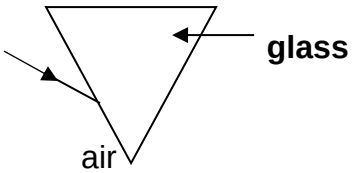
1.



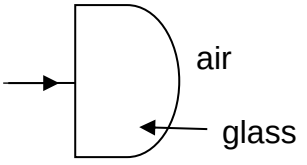
2.



3.



4.



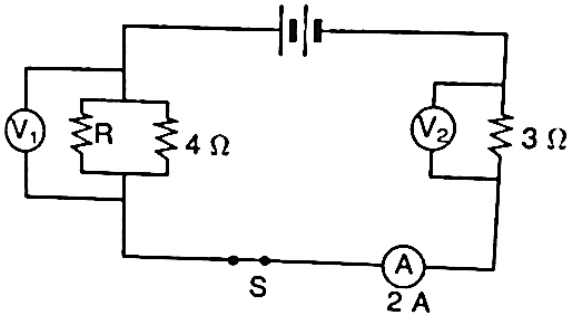
9.3.1 Define the term *total internal reflection*. (3)

9.3.2 Copy diagrams 3 and 4 to the ANSWER BOOK and complete each diagram showing the path of the light rays. (6)

[26]

QUESTION 10: ELECTRICITY

When switch S in the accompanying circuit is closed, the reading on the ammeter is 2 A and the reading on the voltmeters V_1 and V_2 are equal.



Use the circuit diagram to calculate:

10.1 Each voltmeter reading (3)

10.2 The potential difference across the battery (3)

10.3 The resistance of resistor R (6)

[12]

QUESTION 11: MAGNETISM

11.1 Name THREE ways to increase the strength of an electromagnet. (3)

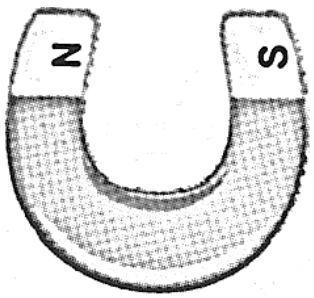
11.2 Good conductors allow electrons to pass through easily.

Name FOUR examples of good conductors of charge. (4)

11.3 What is an *electromagnet*? (3)

11.4 The sketch below is an example of a horseshoe magnet, which is also a permanent magnet.

Draw the pattern of the magnetic field around the poles of the magnet and clearly indicate the field direction.



(6)

[16]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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FORMULA SHEET

TABLE 1: PHYSICAL CONSTANTS

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

TABLE 2: FORMULAE

MECHANICS

$v = u + at$	$E_k = \frac{1}{2} mv^2$
$v^2 = u^2 + 2as$	$E_p = mgh$
$S = ut + \frac{1}{2} at^2$	MA = load / effort
$S = \frac{1}{2}(v+u)t$	VR = effort distance / load distance
$F = mg$	$W = F \times S$
	Efficiency = MA / VR

WAVES, SOUND AND LIGHT

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

MAGNETISM AND ELECTRICITY

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

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