higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(First Paper)
NQF LEVEL 2

(10021002)

12 March 2018 (X-Paper)
09:00–12:00

Scientific calculators may be used.

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

NCV

Copyright reserved

TIME: 3 HOURS
MARKS: 150

INSTRUCTIONS AND INFORMATION

1. Read ALL the questions carefully.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Start each section on a NEW page.
5. Write neatly and legibly.

NCV

SECTION A

QUESTION 1

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

1.1 A physical quantity that has both magnitude and direction

1.2 Energy of an object due to its change of position relative to the centre of the earth

1.3 The force between the object and the surface, that has the effect of opposing motion

1.4 Type of waves in which their vibrations are at right angles to the direction of propagation

1.5 A space around a magnet where magnetic forces can be detected

(5 × 1) **[5]**

QUESTION 2

Choose a word or 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	Time needed to produce a wave	A	light
2.2	Measure of the easiness with which a charge flows in a particular material	B	potential energy
		C	lever
2.3	Kinetic energy + potential energy	D	frequency
2.4	Example of a simple machine	E	insulator
2.5	Form of electromagnetic radiation	F	resistance
		G	period
		H	mechanical energy
		I	wave
		J	displacements

(5 × 1) **[5]**

NCV

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 A wavelength is the distance between two adjacent points of a wave which are in phase.

3.2 Velocity refers to the rate at which displacement is covered.

3.3 Magnetic fields usually distribute evenly around a spherical surface, but tend to concentrate at the parts of a conductor that has a sharp point.

3.4 In the second class lever, the resistance force (load) is situated between the fulcrum and effort force.

3.5 Alternating current is a flow of charge in the same direction.

(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 Which ONE of the following groups consist ONLY of scalar quantities?

A Velocity, acceleration, weight
B Velocity, work, kinetic energy
C Velocity, position, force
D Mass, speed, time

4.2 In order to calculate the wavelength of a given wave, one would use the following :

A Frequency ÷ speed
B Period × frequency
C Speed ÷ frequency
D Speed ÷ period

4.3 Two resistors, 6Ω and 8Ω, are connected in series to a cell.

Which ONE of the statements is correct?

A The potential difference across each of the resistors is the same
B The power consumed by each of the resistors is the same
C The current in both resistors is the same
D The energy transferred to each resistor is the same

NCNW

4.4 An object is dropped from a certain height.

Which ONE of the following quantities associated with the object decreases with time?

A Weight
B Kinetic energy
C Mechanical energy
D Gravitational potential energy

4.5 The actual mechanical advantage of a simple machine is equal to the ratio of:

A Distance moved by the load to the distance moved by the effort
B The resistance force (load) to the effort force
C Distance moved by the effort to the distance moved by the load
D The efficiency to the mechanical advantage of the machine

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5

5.1 Complete the following table by giving the correct answers to writing the missing information next to the question number (5.1.1–5.1.5) in the ANSWER BOOK.

BASIC UNIT	SYMBOL	USED FOR MEASURING
(5.1.1)	m	length
seconds	(5.1.2)	time
kilogram	(5.1.3)	(5.1.5)
Cubic decimeter	(5.1.4)	volume

(5 × 1) (5)

5.2 Name the instrument used to measure each of the following quantities:

5.2.1 Weight

5.2.2 Angles

(2 × 1) (2)
[7]

NCV

QUESTION 6

6.1 What do you understand by the term *velocity*? (2)

6.2 Distinguish between *distance* and *displacement.* (4)

6.3 Mosa rides on his bicycle to school every day. He takes 35 minutes first rides 5 km south from his home to the nearest town, then turns west and covers 3 km before he reaches a stop sign where he turns north and continues riding for another 9 km to reach his school.

6.3.1 Draw a vector diagram (NOT to scale) which shows Mosa's journey. (4)

6.3.2 Calculate the total distance Mosa covers. (2)

6.3.3 Use the sketch in QUESTION 6.3.1 and find Mosa's final displacement when he reaches the school. (4)

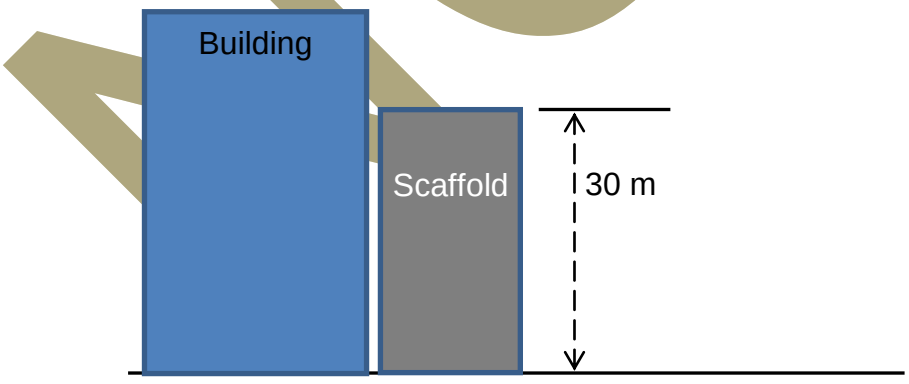
6.3.4 Calculate his average speed and velocity respectively in km/h or m/s. (6)

[22]

QUESTION 7

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

7.2 In a building construction, a 10 kg brick falls freely from a scaffold which is 30 m above the ground.



Ignore air resistance and calculate the following:

7.2.1 Potential energy of the brick on the scaffold 30 m above the ground (4)

7.2.2 Kinetic energy of the brick after it has fallen 20 m from the scaffold. (4)

7.2.3 Kinetic energy of the brick just before it strikes the ground (2)

7.2.4 Velocity with which the brick strikes the ground (4)

7.3 The handles of tin-snips are 150 mm long and the person using them applies a force 40 mm from the end of the handles.

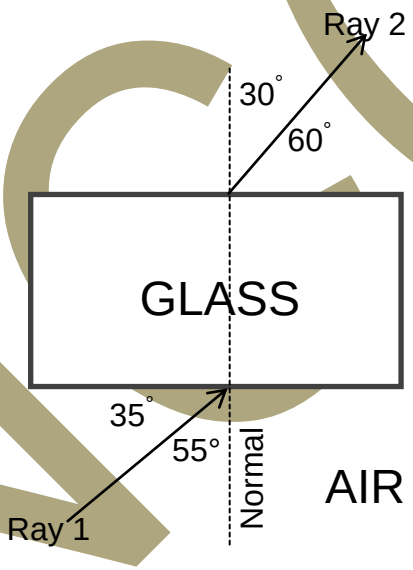
7.3.1 Determine the mechanical advantage if the blades are cutting sheet metal 30 mm from the fulcrum. (3)

7.3.2 How can the mechanical advantage be increased? (2)

7.3.3 How can the mechanical advantage be decreased? (1)
[22]

QUESTION 8

8.1 The diagram below illustrates a ray of light travelling from air into a rectangular glass block.



8.1.1 What name is given to ray 1 and ray 2 respectively?

8.1.2 Write down the value of the angle of incidence.

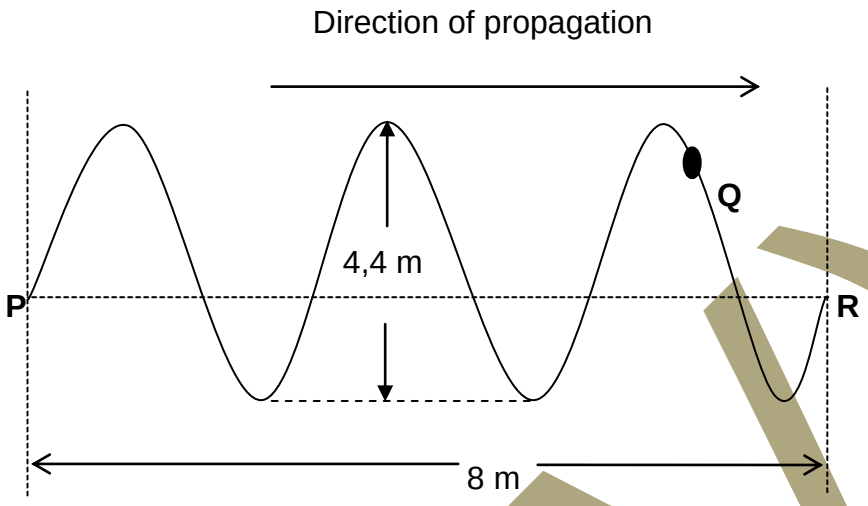
8.1.3 Write down the value of the angle of refraction.

8.1.4 Why does the refracted light bend towards the normal?

(4 × 2) (8)

NCV

8.2 The diagram below, drawn to scale, roughly represents the pattern of waves with a frequency of 20 Hz.



8.2.1 How much time has elapsed while the waves moved from P to R? (3)

8.2.2 Calculate the wavelength of the waves. (2)

8.2.3 What is the amplitude of the wave motion? (2)

8.2.4 In what direction is particle Q about to move? (2)

8.2.5 Calculate the speed of the waves. (3)

8.3 Show, by means of construction, how the image will be formed if an object is placed beyond 2F of a concave surface or mirror. Show ALL the details. (5)

[25]

QUESTION 9

9.1 Explain the following terms that are used in electricity and magnetism:

9.1.1 Electrostatic forces

9.1.2 Conductor

9.1.3 Insulator

(3 × 2) (6)

9.2 State the law of conservation of charge. (2)

NCV

9.3 Three polyester spheres, P, Q and R, with charges -4C, +3C and -4C respectively are brought into contact in the following sequence:

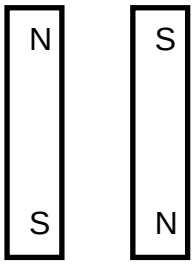
1st P is in contact with Q and released; 2nd R in contact with Q and released.

Now determine the charge on each of them after they are removed. (5)

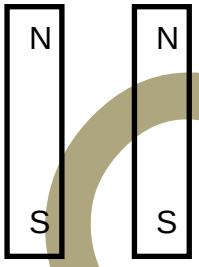
9.4 Mpho rubs a plastic ruler against her jersey. She then picks up small pieces of paper with the ruler. Explain what is happening. (3)

9.5 Draw the magnetic field lines around each of the following pairs of magnets:

9.5.1



9.5.2



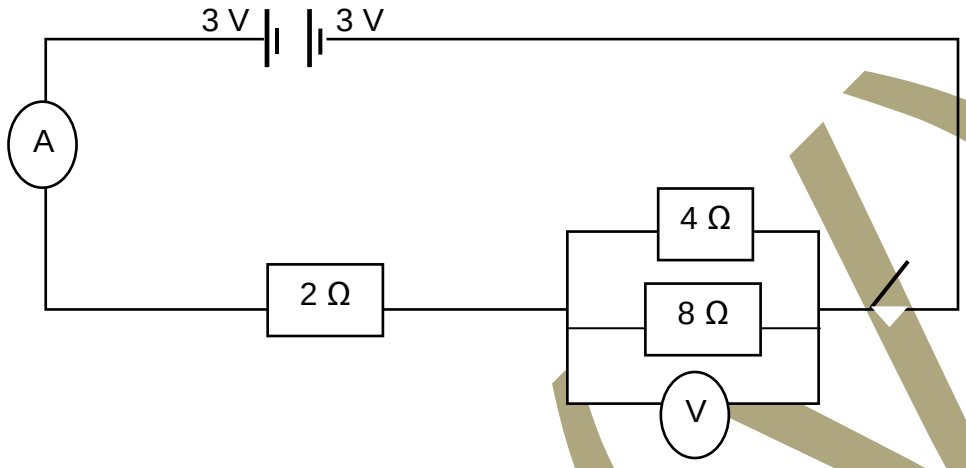
(2 × 3) (6)

[22]

NCM

QUESTION 10

Two resistors, 4 Ω and 8 Ω respectively, are connected in parallel. This combination is then connected in series to a 2 Ω resistor, an ammeter, two 3 V cells (with a negligible internal resistance) and a switch. All connections are made according to the following circuit diagram:



10.1 Calculate the total resistance of the circuit. (4)

10.2 Calculate the reading of the ammeter when the switch is closed. (3)

10.3 Calculate the total EMF of the battery. (2)

10.4 Calculate the reading of the voltmeter V in the circuit. (3)

10.5 The voltmeter is now connected across the 2 Ω resistor.

What will the reading on the voltmeter now be? (2)

10.6 The 4 Ω resistor burns out.

Explain what will happen to the value of the ammeter reading. (3)
[17]

TOTAL SECTION B: 115
GRAND TOTAL: 150

Copyright reserved

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

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

WAVES, SOUND AND LIGHT

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

MAGNETISM AND ELECTRICITY

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

NCNW

Copyright reserved