higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(First paper)
NQF LEVEL 2

(10021002)

8 December 2020 (X-paper)
09:00–12:00

This question paper consists of 9 pages and 1 information sheet.

441Q1N2008

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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 by writing it next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 Rate at which the velocity of an object changes

1.2 A negatively charged ion

1.3 Amount of force needed to give an object with a mass of 1kg an acceleration of $1 m.s^{-2}$

1.4 Frequent regular change between two limits

1.5 Materials that do not conduct electrical current

(5 × 1) **[5]**

QUESTION 2

Choose a term from COLUMN B that matches a description 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	Ability of component to resist flow of electric current	A	wavelength
2.2	Distance between any two consecutive points that are in phase	B	frequency
2.3	Energy object has because of its velocity or position	C	potential energy
2.4	Amount of matter that an object contains	D	resistance
2.5	Instrument that is used to measure current in a circuit	E	mass
		F	ammeter
		G	mechanical energy
		H	ohm

(5 × 1) **[5]**

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 The period (T) of a vibration is the time required to complete one full vibration.

3.2 Gold is an example of a good conductor.

3.3 Transverse waves move at 30° to the direction of motion of the waves.

3.4 Power refers to the rate of flow of charge per second.

3.5 One volt is the same as one joule per coulomb.

(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 The SI unit for gravitational acceleration is …

A $kg.m.s^{-1}$.
B $kg.m.s^{-2}$.
C $kg.m^{-2}.s^{-2}$.
D $kg.m^{-1}.s^{-1}$.

4.2 Energy transferred per unit electric charge:

A Potential difference
B Volt
C Charge
D Coulomb

4.3 Number of waves passing a point every second:

A Amplitude
B Wavelength
C Frequency
D Speed

4.4 Slope of tangent to position versus time graph:

A Average velocity
B Average acceleration
C Instantaneous velocity
D Instantaneous acceleration

4.5 As light rays from the air strike the dividing surface between air and water obliquely, the rays are refracted …

A to skim to the surface of the water.
B away from the normal.
C towards the normal.
D according to the rules of total internal reflection.

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5: MEASUREMENTS

5.1 Write down the unit of measurement for each of the following:

5.1.1 Potential difference

5.1.2 Mass

5.1.3 Resistance

(3 × 1) (3)

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

5.2.1 Mass of brick

5.2.2 Hours in a day

(2 × 1) (2)

5.3 Calculate the volume in m^3 of a liquid in a rectangular tank with the following dimensions:

Length = 50 cm, breadth = 350 mm, height = 2,5 m (4)
[9]

QUESTION 6: MECHANICS

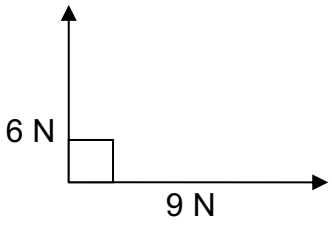
6.1 Explain the difference between *speed* and *velocity.* (4)

6.2 It takes a car 120 seconds to travel on a straight, horizontal road between two traffic lights which are 2 145 m apart. The car starts from rest at the first traffic light and moves with constant acceleration for 30 seconds until it reaches a speed is 22 $m.s^{-1}$. It maintains this speed of 22 $m.s^{-1}$ for T seconds. The car then slows down at a constant negative acceleration (deceleration) before coming to rest at the second traffic light.

6.2.1 Draw a rough sketch of a speed/time graph for the motion of the car between the two traffic lights. (6)

6.2.2 Calculate the value of T. (4)

6.3 In the diagram below two forces, 6 N and 9 N, form an angle of 90° with each other.



6.3.1 Define the term *resultant force*. (2)

6.3.2 Graphically determine the resultant force exerted on the graph. Use scale 10 mm:1 N. (6)

6.3.3 Write down the magnitude of the equilibrant. (2)

[24]

QUESTION 7: MECHANICAL ADVANTAGE

7.1 Use an equation and prove that 1 J = $kg.m^2.s^{-2}$. (3)

7.2 An object with a mass of 10 kg is projected vertically upwards with an initial velocity of 20 $m.s^{-1}$. Ignore air friction.

Calculate each of the following:

7.2.1 Kinetic energy of the object when it returns to the ground (3)

7.2.2 Maximum height the object will reach above the ground (4)

7.3 Name THREE types of energy, except for the one named in QUESTION 7.2.1. (3)

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7.4 State the *law of simple machines*. (3)

7.5 A resistance of 1 300 N is overcome by a simple machine with a velocity ratio (VR) of 7 and an efficiency of 85%.

Calculate each of the following:

7.5.1 Mechanical advantage (3)

7.5.2 Effort required to overcome resistance (4)

7.6 Is it possible that mechanical advantage can be greater than the velocity ratio? Explain the answer. (3)
[26]

QUESTION 8: WAVES, SOUND AND LIGHT

8.1 Explain each of the following terms:

8.1.1 Superposition of waves

8.1.2 Constructive interference

8.1.3 Destructive interference

(3 × 3) (9)

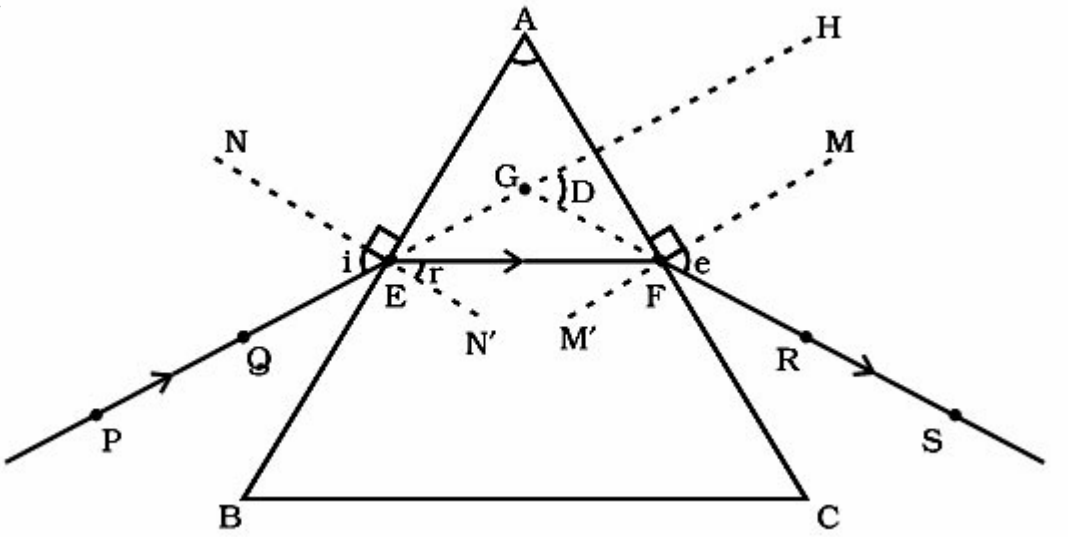
8.2 Draw a simple transverse wave and clearly indicate the amplitude, wavelength, direction of propagation, peak and trough. (6)

8.3 A sound wave travels through the air at 330m.s^{-1} and has a frequency of 10 Hz.

8.3.1 Calculate the wavelength of the sound. (3)

8.3.2 What is the period of the wave? (2)

8.4 Study the diagram below illustrating a ray of light shining through a triangular glass prism.

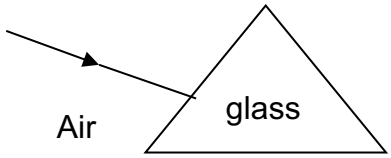


8.4.1 Which letter(s) represents the angle of deviation in the diagram? (2)

8.4.2 Identify the letter(s) which represent angles of incidence. (2)

8.4.3 Why does the light ray bend near to the normal? (3)

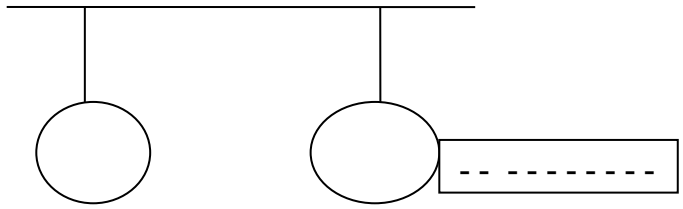
8.5 Copy the diagram below and show the path of the light ray travelling through the air and striking the surface of the triangular glass prism.



(3)
[30]

QUESTION 9: MAGNETISM AND ELECTROSTATICS

9.1 Two graphite-covered polyethene spheres are suspended from thin strings as indicated below. A negatively charged PVC rod is moved closer to one of the spheres and touches it.



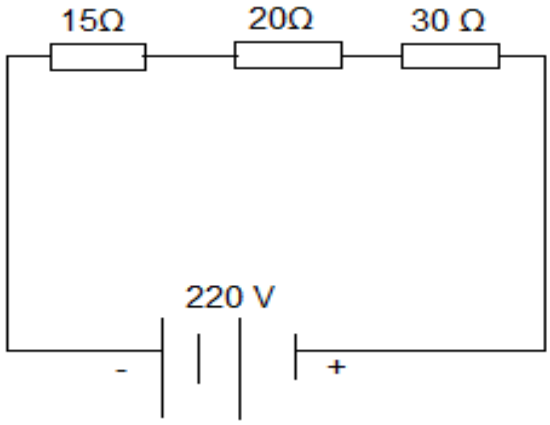
9.1.1 Explain what is meant by a negatively charged object. (3)

9.1.2 Briefly explain what happens to the sphere when the negatively charged rod touches it. (4)

9.1.3 What is the purpose of the graphite around the sphere? (2)

9.1.4 Name and state the law at work in QUESTION 9.1.2. (3)

9.2 The diagram below shows a circuit of three resistors and a battery.



Calculate each of the following:

9.2.1 Total resistance of the circuit (4)

9.2.2 Total current flowing in the circuit (4)

9.2.3 Potential difference across each resistor (6)
[26]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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PHYSICAL SCIENCE L2 P1

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 x 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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