higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE

(First paper)

NQF LEVEL 2

(10021002)

11 March 2020 (Y-paper)
13:00–16:00

A non-programmable calculator may be used.

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

505Q1S2011

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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. Use only a black or blue pen.
7. 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 Succession of transverse pulses

1.2 Requires magnitude and direction for its complete specification

1.3 Type of image formed in a plane mirror

1.4 The maximum displacement from its equilibrium position of a medium carrying a wave

1.5 The rate at which a charge flows through an electric circuit

(5 × 1) **[5]**

QUESTION 2

Choose an SI unit from COLUMN B that matches a term 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	Resistance	A	ampere
2.2	Weight	B	second
2.3	Energy	C	newton
2.4	Time	D	metre per second
2.5	Frequency	E	kilogram
		F	hertz
		G	ohm
		H	joule

(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 Unlike poles repel each other.

3.2 A pulse is a single disturbance that is propagated from one end to another in a medium.

3.3 Resistors in series are potential dividers.

3.4 The motion of an object involves the change in its position.

3.5 Current is directly proportional to potential difference at constant temperature.

(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 distance that any pulse can move in one second, is the wave …

A speed.
B period.
C frequency.
D length.

4.2 The gravitational potential energy of an object relative to the ground is dependent on the object's …

A speed.
B position.
C velocity.
D change in velocity.

4.3 Which ONE of the following is a poor conductor or insulator?

A Aluminium
B Copper
C Silver
D Wood

4.4 How many vector and scalar quantities does the formula W = F × s contain?

A One scalar quantity and two vector quantities
B Two scalar quantities and one vector quantity
C Three scalar quantities
D Three vector quantities

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4.5 When light enters glass from air with an angle of incidence of 30°, the angle of refraction will be …

A 90°.
B 30°.
C 45°.
D 25°.

(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 35 g to mg

5.1.2 1 000 mm to m

(2 × 1) (2)

5.2 Write each of the following in symbols:

5.2.1 Megavolt

5.2.2 Milligram

(2 × 1) (2)

5.3 Calculate the volume of a table with the following dimensions:

Length = 20 cm
Breadth = 25 mm
Height = 2,5 m

(4)
[8]

QUESTION 6: MECHANICS

6.1 Explain the term *acceleration*. (2)

6.2 A Greyhound bus carrying spectators to the FNB Stadium travels along a straight level road. The brakes are applied and the bus decelerates uniformly from a speed of 36 $m.s^{-1}$ to come to a standstill within 14 s.

Calculate:

6.2.1 The acceleration of the bus

6.2.2 The distance the bus moved from when the bus driver started braking

(2 × 4) (8)

6.3 Identify which of the quantities in the list below are vectors and which are scalars by writing the answers next to the question number (6.3.1–6.3.2) in the ANSWER BOOK.

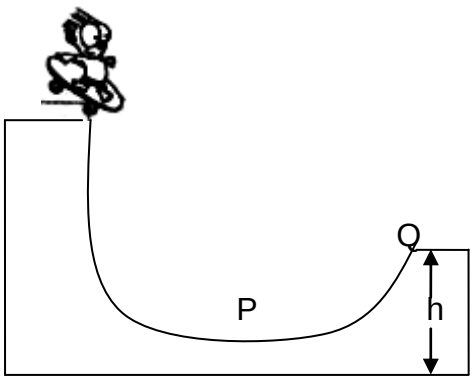
time; mass; weight; distance; displacement; speed; velocity; acceleration

6.3.1 Vectors

6.3.2 Scalars

(2 × 2) (4)

6.4 Assume that the skating ramp below is frictionless. A skateboarder with a mass of 40 kg is skating on the ramp on his skateboard with a mass of 5 kg. At position P his speed is 6 $m.s^{-1}$. He skates up the right side of the ramp and reaches position Q at a speed of 1 $m.s^{-1}$.



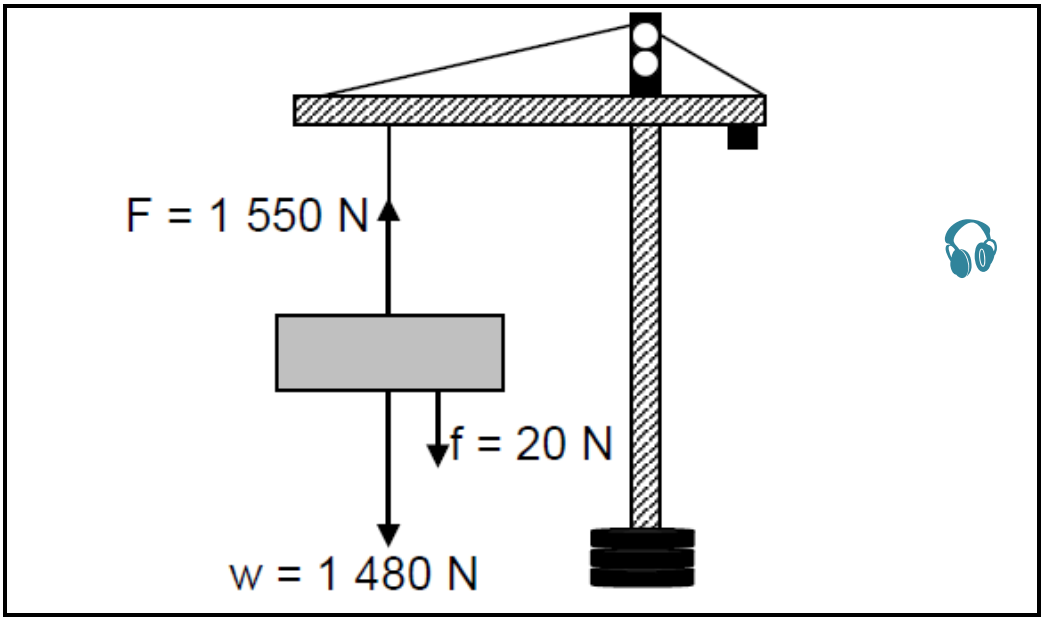
6.4.1 Calculate the skateboarder's kinetic energy at P. (4)

6.4.2 Calculate the height h that the skateboarder will reach when he is moving at a speed of 1 $m.s^{-1}$ at point Q. (6)

[24]

QUESTION 7

The diagram below shows a bucket of water lifted up with a pulley. The magnitude and direction of the forces are shown on the diagram.



7.1 Name the THREE forces acting on the pulley and state whether they are contact or noncontact forces. (3 × 2) (6)

7.2 Calculate the mass of the bucket. (4)

7.3 Is the bucket moving up or down? Give a reason for the answer. (4)

7.4 Calculate the mechanical energy of the bucket when it is stationary at a height of 50 mm above the ground. (4)

[18]

QUESTION 8: MECHANICAL ADVANTAGE

8.1 A lever is used to lift a stone weighing 800 N over a height of 130 mm. An effort of 115 N is applied over a distance of 1,6 m to lift the stone.

Calculate:

8.1.1 The mechanical advantage

8.1.2 The velocity ratio

(2 × 3) (6)

8.2 Define the ratio calculated in QUESTION 8.1.2. (2)

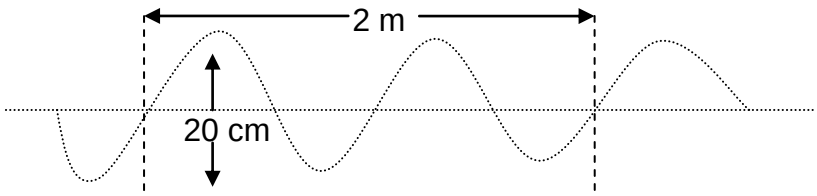
[8]

QUESTION 9: WAVES, SOUND AND LIGHT

9.1 Tabulate THREE differences between sound and light waves. (3 × 2) (6)

9.2 Calculate the frequency with which a guitar string vibrates to produce a sound wave with a wavelength of 0,3 m. Accept the speed of light as 330 $m.s^{-1}$. (4)

9.3 The wave motion illustrated in the diagram below completes three vibrations in 15 seconds.



9.3.1 How long does it take four waves to pass a specific point? (3)

9.3.2 What is the period of the waves? (2)

9.3.3 Calculate the speed of the waves. (4)

9.4 Give THREE properties of electromagnetic waves. (3)

9.5 Draw neat, labelled sketches showing the reflection of light rays by the following:

9.5.1 Plane mirror (3)

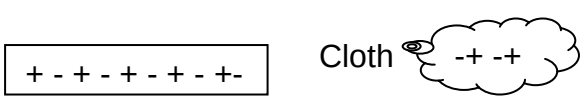
9.5.2 Concave mirror (4)

[29]

QUESTION 10: MAGNETISM AND ELECTRICITY

10.1 Explain the principle of conservation of charge. (3)

10.2 A teacher demonstrates a certain electrostatic principle to learners. The teacher rubs a neutral plastic ruler with a neutral woollen cloth as indicated below.



10.2.1 Which charge did the ruler gain? (2)

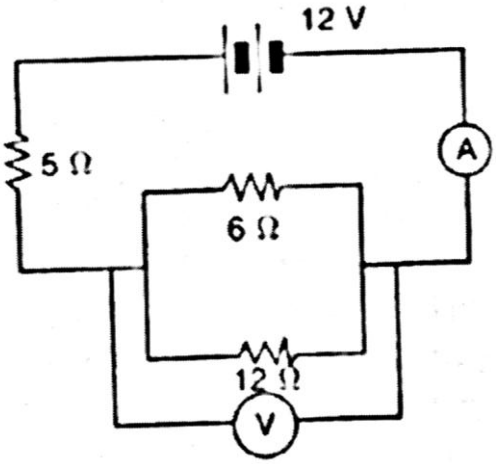
10.2.2 Did the cloth gain a charge? Explain the answer. (5)

10.2.3 The charged ruler is held near a few pieces of paper. The paper is attracted to the ruler.

Is the piece of paper electrically charged? Explain the observation. (5)
[15]

QUESTION 11

A 12 V battery is connected in a circuit as shown below:



Calculate:

11.1 The total resistance of the circuit (4)

11.2 The reading on the ammeter (3)

11.3 The reading on the volt meter (3)

11.4 The current flowing through the 6 Ω resistor (3)
[13]

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

$v = u + at$	$E_k = ½mv^2$
$v^2 = u^2 + 2as$	$E_p = mgh$
$s = ut + ½ at^2$	*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

$R = r_1 + r_{2 +} r_3$	$Q = It$
$1/R = 1/r_1 + 1/r_2 + 1/r_3$	$E = IR + Ir$
$V = IR$	$V = W/Q$

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