
DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
ENGINEERING SCIENCE N1
TIME: 3 HOURS
MARKS: 100

APRIL 2012

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
 2. Read ALL the questions carefully.
 3. Number the answers correctly according to the numbering system used in this question paper.
 4. Write neatly and legibly.
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QUESTION 1

- 1.1 Choose a description from COLUMN B that matches a term in COLUMN A. Write only the letter (A – H) next to the question number (1.1.1 – 1.1.8) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1.1	Scalar	A	actual route followed by the object
1.1.2	Vector	B	length of straight line between two points
1.1.3	Distance	C	quantity that has magnitude and direction
1.1.4	Displacement	D	indication of the gravitational force between a body and the earth
1.1.5	Speed	E	the amount of matter a body consists of
1.1.6	Velocity	F	quantity that has only magnitude
1.1.7	Mass	G	displacement during a time interval
1.1.8	Weight	H	distance during a time interval

(4)

- 1.2 A boat starts sailing on Monday 10:00 at harbour A and sails 600 km due North. Later it turns due East for a further 420 km to reach harbour B on Tuesday at 12:00.

Calculate the following:

- 1.2.1 Total distance travelled from A to B (1)
1.2.2 Total displacement from A to B (2)
1.2.3 Average speed of the trip (2)
1.2.4 Average velocity of the trip (2)
- 1.3 Calculate the acceleration of a motor car moving from rest to 90 km/h in 15 seconds. (2)
- 1.4 Determine the weight of an electric motor which has a mass of 68 kg. (1)

[14]

QUESTION 2

2.1 A force can have certain effects on an object. State FOUR of these effects. (2)

2.2 Define each of the following:

2.2.1 Triangle of forces (1)

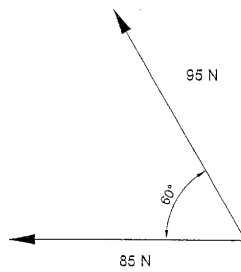
2.2.2 Resultant (1)

2.2.3 Mechanical advantage (1)

2.2.4 Torque (1)

2.3 The following sketch shows two forces acting in on a body. Copy the drawing in the ANSWER BOOK and determine the resultant force and the equilibrant of the TWO forces by using the parallelogram method.

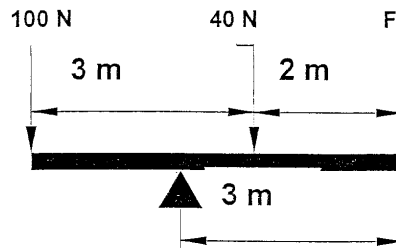
HINT: Scale diagram



(4)

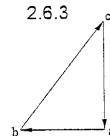
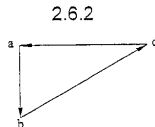
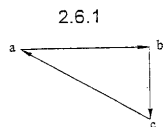
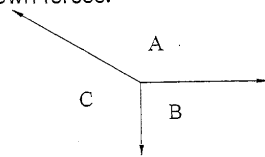
2.4 Draw a neat, labelled simple wheel-and-axle lifting machine. Add where the force is applied and where the load is lifted up. (3)

2.5 Calculate the unknown force F by using the Law of Moments:



(3)

- 2.6 Show which of the following triangles is the correct application of Bow's notation clockwise of the shown forces:



(2)
[18]

QUESTION 3

- 3.1 Define the *conservation of energy*. (2)

- 3.2 A horizontal force of 230 N is required to pull a trolley 30 m, at constant speed, across a horizontal surface in 40 sec.

Determine the following:

- 3.2.1 The work done (2)
 3.2.2 The speed of the trolley (2)
 3.2.3 The power required (2)
 3.2.4 The time that it would take to cover a distance of 135 m at the same speed (2)

- 3.3 Give an example of each form of energy:

- 3.3.1 Kinetic energy
 3.3.2 Potential energy
 3.3.3 Electrical energy
 3.3.4 Chemical energy (2)

[12]

QUESTION 4

4.1 What is the difference between temperature and heat? (2)

4.2 Compare the advantages of the mercury thermometer with those of an alcohol thermometer (FOUR of each). Copy the table below in the ANSWER BOOK and complete it.

	MERCURY THERMOMETER	ALCOHOL THERMOMETER
4.2.1		
4.2.2		
4.2.3		
4.2.4		

(4)

4.3 How is heat propagated in the following phases (processes)?

- 4.3.1 Solids
- 4.3.2 Liquids
- 4.3.3 Gases
- 4.3.4 Vacuum

(2)

4.4 Draw a neat, labelled diagram of a pyrometer. (4)

4.5 What effect does the bi-metallic strip represent? (1)

4.6 When 120 kJ of energy is added to 15 kg of brass the temperature rises to 52 °C. If the specific heat capacity of brass is 393 J/kg °C, calculate the initial temperature of the brass. (3)

4.7 A water pipe has a length of 30 m at midday. During the night the length changes to 29,544 m. Calculate the change in length of the pipe in mm. (2)

[18]

QUESTION 5

5.1 Define each of the following:

- 5.1.1 Matter
- 5.1.2 Melting

(1)

(1)

5.2 Matter can be found in three phases namely solids, liquids and gasses. Give TWO examples of each of these phases. (3)

5.3 What causes matter to change a phase? (1)

(1)

5.4 Draw a neat, labelled structure of an atom. (4)

(4)

5.5 State TWO characteristics of solids. (2)

[12]

QUESTION 6

- 6.1 Define each of the following:
- 6.1.1 Ampere (1)
 - 6.1.2 Conductor (1)
 - 6.1.3 Joule's law (1)
 - 6.1.4 Direct current (1)
- 6.2 Draw the symbols for each of the following electrical components:
- 6.2.1 Resistor ($\frac{1}{2}$)
 - 6.2.2 Switch ($\frac{1}{2}$)
 - 6.2.3 Cell ($\frac{1}{2}$)
 - 6.2.4 Galvanometer ($\frac{1}{2}$)
- 6.3 An element of a kettle has a resistance of 45Ω and a current of 5 A is flowing through the element. Calculate the potential difference over the element. (2)
- 6.4 Three resistors of 9Ω , 24Ω and 16Ω respectively are connected in parallel with a 12 V battery.
- 6.4.1 Draw a neat circuit diagram of the circuit. (2)
 - 6.4.2 Calculate the total resistance of the circuit. (2)
 - 6.4.3 Calculate the total current of the circuit. (2)
 - 6.4.4 Calculate the total power consumed in the circuit. (2)
- 6.5 What influence does the length of a conductor have on the resistance of a conductor? (1)
- 6.6 If the temperature of silver increases, what effect will it have on the resistance of the metal? (1)
- 6.7 Patric leaves a heater on in his room. The heater element has a resistance of 50Ω and is left on for one hour. If a current of 15 A flows through the element, calculate the heat energy given off by the heater. (2)
- 6.8 Draw a neat, labelled solenoid and its magnetic field around it. (3)
- 6.9 Describe the working of a single stroke doorbell in words. (3)

[26]

TOTAL: 100