

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

AUGUST 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 Define *velocity*. (1)

1.2 Indicate whether the statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.2.1 – 1.2.4) in the ANSWER BOOK.

	QUANTITY	VECTOR OR SCALAR
1.2.1	A man weighs 600 N	Scalar
1.2.2	60 seconds	Vector
1.2.3	A ray of lightning	Vector
1.2.4	A bullet travelling south at 400 m/s	Vector

(2)

1.3 A missile travelling at a constant velocity takes 5 seconds to reach its target 1 km away. Use scales of 2 cm = 1 s and 1 cm = 100 m and draw a displacement/time graph. Use the graph to determine the following:

(3)

1.3.1 The gradient of the slope (1)

1.3.2 The velocity of the missile (2)

1.3.3 The time a similar missile would take to reach a target 650 m away (1)

1.4 FIGURE 1 shows the dimensions of a sports field. A man runs one and a half times around the field. If he started running from the halfway line (point A):

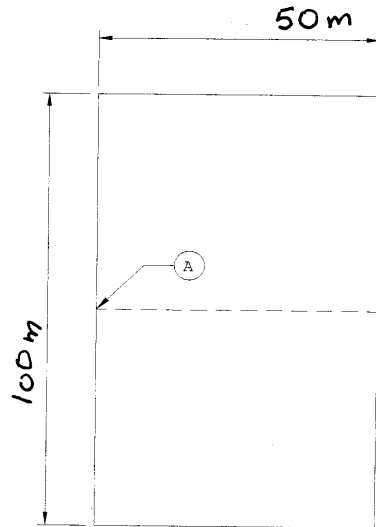


FIGURE 1

1.4.1 What was his displacement? (1)

1.4.2 How far did he run? (1)

1.5 Explain the difference between *mass* and *weight*. (2)

[14]

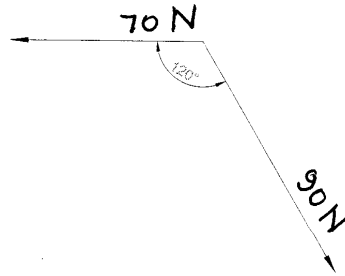
QUESTION 2

2.1 Define the following:

- 2.1.1 Equilibrant
- 2.1.2 Law of moments
- 2.1.3 Displacement ratio

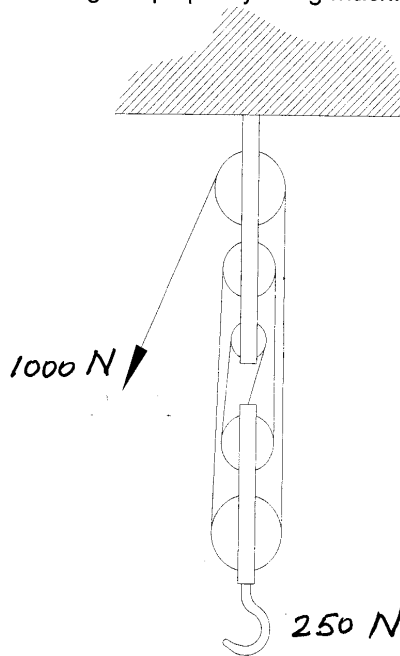
(3)

2.2 Determine the equilibrant of the following forces working in on the same point:



(3)

2.3 The figure below shows a single rope pulley lifting machine.



Calculate the following:

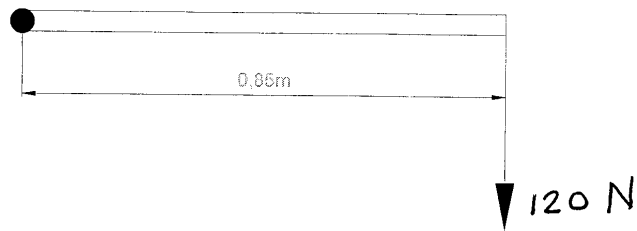
- 2.3.1 Mechanical advantage
- 2.3.2 Displacement ratio

(2)
(2)

2.4 Name TWO examples where the application of torque is seen or evident.

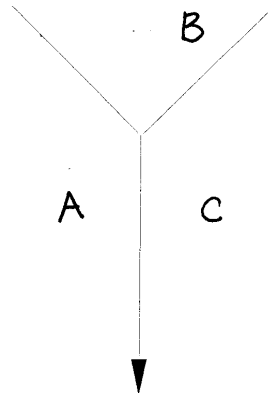
(1)

2.5 Calculate the torque of the following apparatus:



(2)

2.6 The figure shows THREE forces in balance. Don't draw the forces again. Draw a triangle of forces and apply Bow's notation clockwise to the triangle.



(3)

2.7 Draw a neat, labelled drawing of a simple lever.

(2)

[18]

QUESTION 3

3.1 Define *joule*.

(1)

3.2 Draw a force/distance graph of work done to hoist a lift through six floors. The mass of the lift is 500 kg and the distance between the floors is 2,1 m.

Use the graph to determine the work done.

Use the following scale: 10 mm = 1 m and 10 mm = 500 N.

(5)

- 3.3 The power required to tow a trailer at a constant speed of 90 km/h on a level road is 35 kW. Determine:
- 3.3.1 The speed of the trailer in m/s (1)
 - 3.3.2 The force in the towbar (2)
 - 3.3.3 The work done in 2,5 minutes, given in MJ (2)
- 3.4 Define *power*. (1)
- [12]**

QUESTION 4

- 4.1 With what is the temperature of a body measured if it is at the following temperatures:
- 4.1.1 A is at 40 °C
 - 4.1.2 B is at 400 °C
 - 4.1.3 C is at 4 000 °C (3)
- 4.2 Copy the following TABLE in the ANSWER BOOK and fill in only 'YES' or 'NO' next to the question numbers:

COMPARE	MERCURY	COLOURED ALCOHOL
Transparent	4.2.1	4.2.2
Sticks to glass	4.2.3	4.2.4
Uniform expansion	4.2.5	4.2.6

(3)

- 4.3 When heat is added to or removed from a substance, changes take place. Name FOUR of these changes (effects of heat). (2)
- 4.4 58,5 kJ of heat energy is absorbed by a copper cylinder which has a mass of 2 kg. The initial temperature was 20 °C and the specific heat capacity of copper is 390 J/kg °C.
- Calculate the following:
- 4.4.1 The rise in temperature (change in temperature) (2)
 - 4.4.2 The final temperature (2)
- 4.5 Give TWO examples of the use of bimetal strips in practice. (2)
- 4.6 A copper pipe, 4 m long at an initial temperature of 10 °C, expands by 5,5 mm when the temperature increases to 95 °C. Calculate the final length of the copper pipe. (2)
- 4.7 What is the difference between *heat capacity* and *specific heat capacity*? (2)
- [18]**

QUESTION 5

5.1 Matter can be found in three phases, namely: solids, liquids and gasses. Describe the *movement of particles* in each phase. (3)

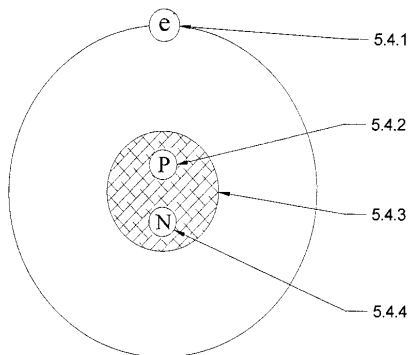
5.2 Name the process when the following phase changes take place:

- 5.2.1 Solid changes to liquid
- 5.2.2 Gas changes to liquid
- 5.2.3 Liquid changes to solid (3)

5.3 Define the following:

- 5.3.1 Atom
- 5.3.2 Molecule (2)

5.4 The following drawing shows the structure of an atom. Name EACH part as well as the charge of EACH part. Write the answer next to the question number (5.4.1 – 5.4.4) in your ANSWER BOOK.



(4)
[12]

QUESTION 6

6.1 Define the following:

- 6.1.1 Potential difference (1)
- 6.1.2 Ohm's Law (1)
- 6.1.3 Resistivity (1)

6.2 Draw the symbols for the following electrical components:

- 6.2.1 Variable resistor (1/2)
- 6.2.2 Ammeter (1/2)
- 6.2.3 Battery (1/2)
- 6.2.4 Voltmeter (1/2)

- 6.3 Name a source for the following currents:
 - 6.3.1 Direct current (DC) (1)
 - 6.3.2 Alternating current (AC) (1)
- 6.4 Calculate the resistance of a heater element if a current of 2.2 A flows through it and a voltage of 220 V is applied over the heater. (2)
- 6.5 An electrical circuit consists of THREE resistors connected in series. The respective values of the resistors are: 13 Ω , 28 Ω and 136 Ω .
 - 6.5.1 Draw a diagram of the circuit. (2)
 - 6.5.2 Calculate the total resistance of the circuit. (2)
 - 6.5.3 If the THREE resistors are connected to a 24 V battery, calculate the total current flowing in the circuit. (2)
- 6.6 What effect does the type of metal (resistivity) have on the resistance of an electrical conductor? (1)
- 6.7 What effect does a decrease in temperature have on an alloy like brass? (1)
- 6.8 Name TWO of the three factors that influence the amount of heat energy released by an electrical conductor. (1)
- 6.9 An electrical incandescent lamp is marked 100 W, 220 V.
Calculate the following:
 - 6.9.1 The current flowing in the lamp (2)
 - 6.9.2 The resistance of the lamp (2)
- 6.10 Draw a neat, labelled sketch to illustrate the working of a relay-switch. (4)

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TOTAL: 100