higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

INSTRUMENTATION TECHNOLOGY
NQF LEVEL 3

18 February 2025

This marking guideline consists of 7 pages.

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QUESTION 1

1.1
1.1.1 False
1.1.2 False
1.1.3 False
1.1.4 True
1.1.5 True
1.1.6 True
1.1.7 False
1.1.8 True
1.1.9 False
1.1.10 True

(10 × 1) (10)

1.2 All new instruments have a user guide that gives specific instructions on how to install the device? Follow the instructions exactly to get best results and readings.

- For safety purposes, always close the supply valve upstream of the instrument or open the by-pass valve before you start working on an instrument.✓✓
- Make sure you use a transmitter that was designed to work in the pressure range of the system on which you are working.✓✓
- The pneumatic transmitter and convertor can easily be installed by simply connecting the transmitter to the pipe where you want the pressure to be measured.✓✓
- Place the pneumatic transmitter and convertor on your workplace where you will be able to remove the cover for calibration maintenance.✓✓
- When measuring liquids, the transmitter should be mounted at the same height as the pipe.✓✓ (5 × 2) (10)

1.3
- Preventive maintenance uses predictive analytics to forecast equipment failure and schedule maintenance ahead of time based on historical data.✓✓
- Routine maintenance, on the other hand, may refer to regular maintenance tasks performed on less valuable assets.✓✓ (2 × 2) (4)

[24]

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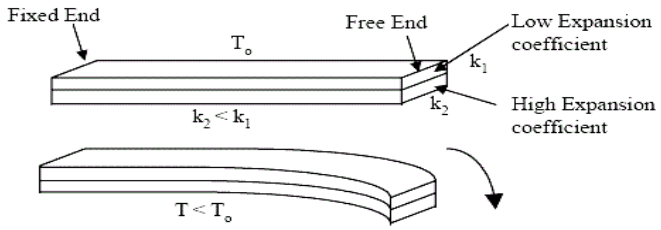
QUESTION 2

2.1 2.1.1 Bimetallic Thermometer



2 marks for showing different material used✓✓
3 marks for the correct drawing✓✓✓ (5)

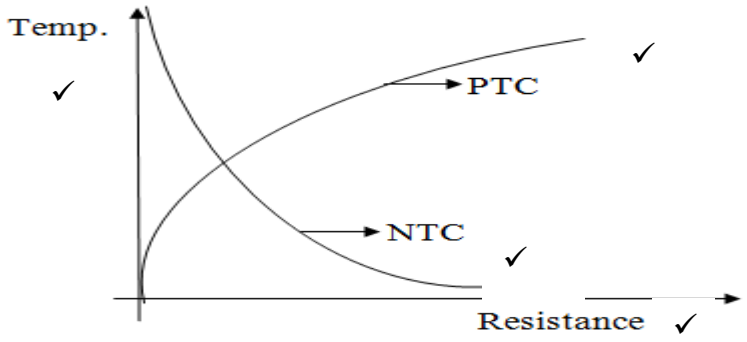
2.1.2 Has no need for ambient temperature.✓✓ (2)

2.1.3
- Thermostat for temperature control.
- Compensation for ambient temperature changes for other types of thermometers. (2)

2.1.4 It is important for metals to have different coefficients of thermal expansion. As the temperature increases✓ the strip will bend towards the side of the metal with a smaller expansion of coefficient.✓✓ (3)

2.2 2.2.1
- Negative temperature coefficient(ntc)
- Positive temperature coefficient(ptc) (2)

2.2.2



(4)

2.2.3
- Non-linear characteristics.
- Prone to self-heating.
- Prone to moisture failure.
- Extremely fragile.
- Limited temperature ranges of operation.
- Prone to permanent de-calibration under high temperatures.

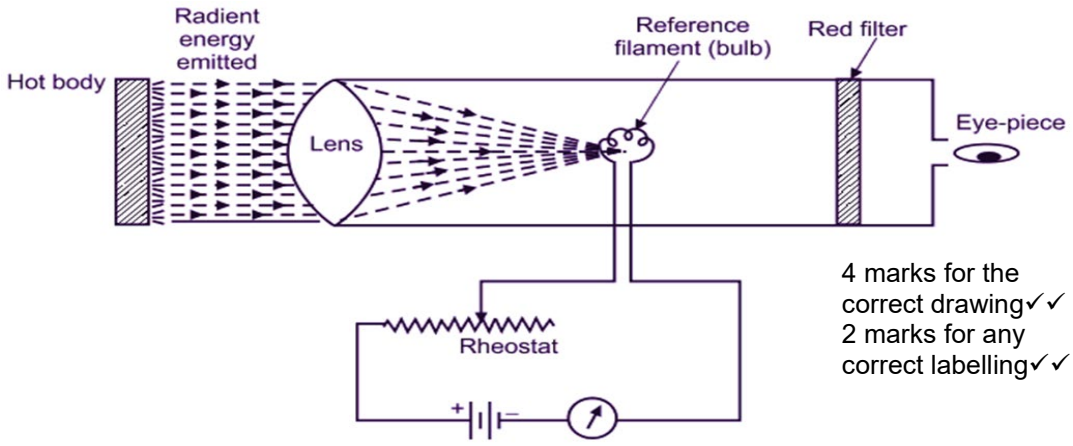
(Any 5 × 1) (5)

2.2.4 Between -55 °C to 300 °C✓✓ (2)

2.2.5
- A simple voltage divider
- An op amp and another resistor
- Advanced op-amp circuits with microcontrollers (3)

2.2.6 When you test its resistance and you get readings of infinite resistance✓ or zero resistance.✓ (2)

2.3



4 marks for the correct drawing✓✓
2 marks for any correct labelling✓✓

(6)
[36]

QUESTION 3

3.1
3.1.1 B
3.1.2 A
3.1.3 A
3.1.4 A
3.1.5 C
3.1.6 D
3.1.7 B
3.1.8 C
3.1.9 C
3.1.10 D

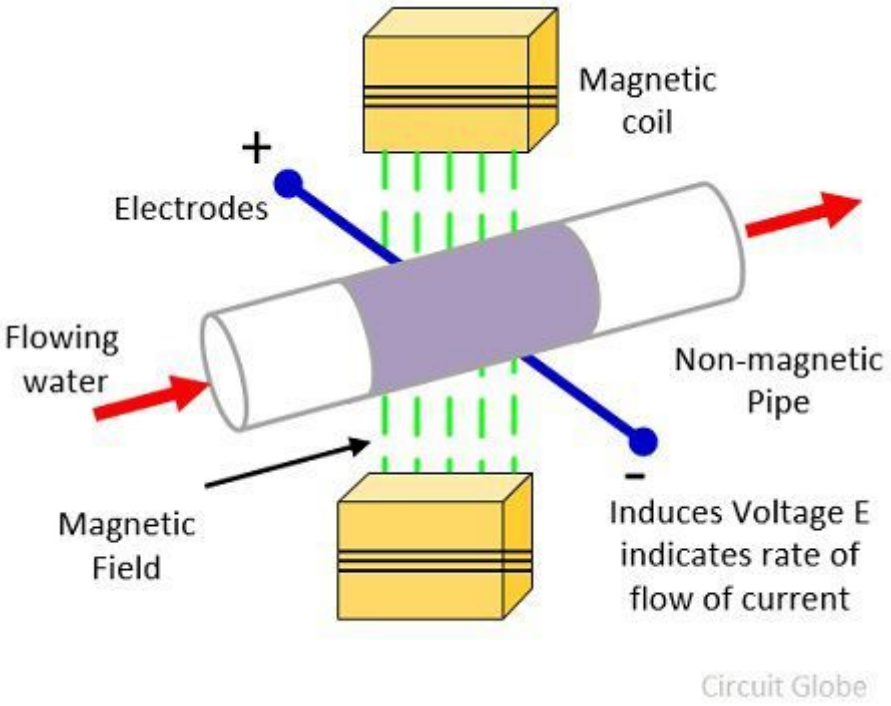
(10 × 1) (10)

3.2 3.2.1
- Corrosion/erosion
- Dirt build-up (2)

3.2.2
- In corrosion, the obstacle gets washed away bit by bit by the liquid flowing over or through it.✓ After a while as obstacle becomes smaller and smaller, your measurements will become less and less accurate.✓✓
- Dirt built-up is caused by impurities in the liquid.✓ Dirt collects in the corners of the obstacle and on the bottom. The head measurement is then smaller than the actual head and when you determine the flow rate, your determined value is also smaller.✓✓ (2 × 3) (6)

3.2.3
- In Corrosion, not much can be done to stop corrosion but you must report it immediately.✓✓
- With built-up dirt it is very important to clean the area around the obstacle and to clean the obstacle itself regularly.✓✓ (2 × 2) (4)

3.3

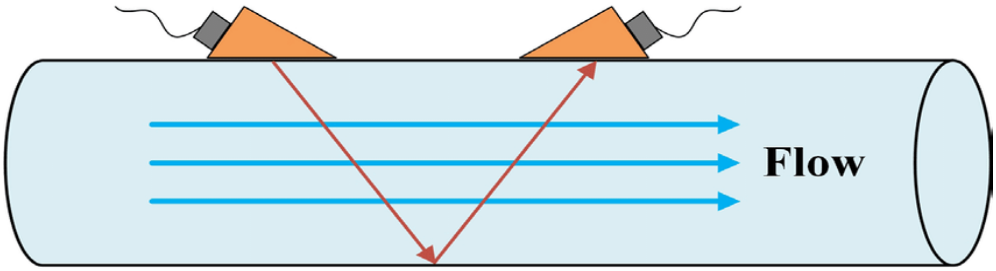


4 marks for the correct drawing✓✓✓✓
1 mark for each correct label✓✓✓✓✓ (10)

3.4
- Transducer✓
  It alternates between transmitting and receiving to measure differences between upstream and downstream transmission.✓
- Transmitter✓
  Converts measurements from the sensor into a signal and sends it, usually electronically, to be received by a display located a distance away.✓
- LCD Screen✓
  Displays the flow rate value.✓
- Preamplifier✓
  Sends out a low-level signal to prepare the main amplifier for the electronic signal it receives.✓
- Keypad✓
  This component allows for the input of parameters such as operating pressure and temperature for the meter to calculate the volumetric flow.✓

(5 × 2) (10)

3.5



3 Marks for correct drawing✓✓✓ (3)
[45]

QUESTION 4

4.1

4.1.1	E
4.1.2	D
4.1.3	H
4.1.4	K
4.1.5	C
4.1.6	A
4.1.7	J
4.1.8	L
4.1.9	F
4.1.10	G

(10 × 1) (10)

4.2 4.2.1 Volume = length × width × l_t ✓
= 2 × 1,5 × 0,6✓
= 1,8 m^3✓ (3)

4.2.2 l_t= Percentage/100 × L_{max}✓
= 70/100 × 3✓
= <u>2,1 m</u>✓

Volume = ώ × r^2 × l✓
= ώ × $1,2^2$ × 2,1✓
= <u>9,140 m^3</u>✓ (6)

4.3
- Do not screw in by turning the housing.
- Seal the thread with Teflon tape before screwing in the switch.
- Use the correct tool to screw in the switch.
- Check that the probes are the correct length for the tank.
- Mount the sensor in the tank so that the probes do not make contact with the wall of the tank.
- Do not mount the sensor near the point where the liquid is pumped into the tank.
- Do not mount the sensor near any other disturbances as this will give you
- inaccurate readings.
- Do not fasten the sensor by turning the housing.
- Use the correct equipment to fasten the seal of the sensor.
- Wear the correct PPE. (Any 10 × 1) (10)

4.4
- Power stations
- Chemical plants
- Water management
- Food industry
- Mining industry (5)

4.5
- Static charge from certain solids
- Conductive material build-up
- Moisture content in solids
- Temperature changes (4)

4.6 They are installed in tanks and pressure vessels.✓ It is therefore important to ensure the tank is safe to work on before you install the instrument.✓ The liquid in the tank or pressure vessel may be flammable, in which case you must not use welding machine or any other equipment that can cause spark. The vibration meter does not need much space, so you can install it almost anywhere.✓✓ (4)

4.7 The meter does not need highly accurate calibration,✓ because it only needs to detect a change in frequency.✓✓ (3)

[45]

TOTAL: 100

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