



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INSTRUMENT TRADE THEORY N2

9 April 2020

This marking guideline consists of 7 pages.

SECTION A**QUESTION 1**

- 1.1 A
- 1.2 C
- 1.3 B
- 1.4 A
- 1.5 C

(5 × 1) **[5]**

QUESTION 2

- 2.1 True
- 2.2 False
- 2.3 True
- 2.4 True
- 2.5 True

(5 × 1) **[5]**

QUESTION 3

- 3.1 Boyle's law
- 3.2 Gauge pressure
- 3.3 Volumetric flowmeter OR Positive displacement flowmeter
- 3.4 Bernoulli's theorem
- 3.5 Density

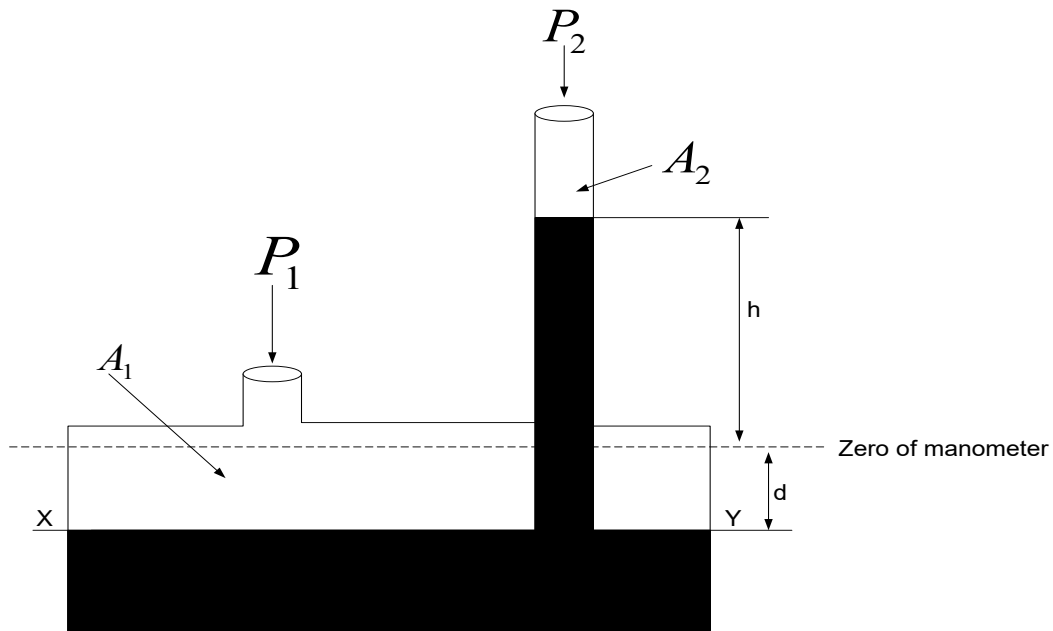
(5 × 2) **[10]**

TOTAL SECTION A: 20

SECTION B

QUESTION 4

4.1



(2 marks for the drawing)
(2 marks for any two correct labels) (4)

4.2

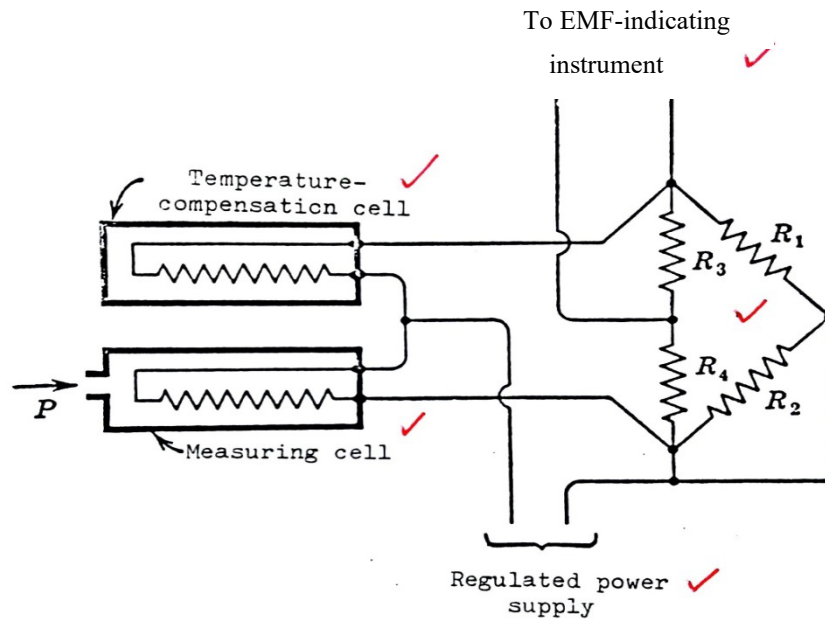
$$\Delta P = \rho g h \left[\frac{A_2}{A_1} + 1 \right]$$

$$h = \frac{\Delta P}{\rho g \left[\frac{A_2}{A_1} + 1 \right]} \checkmark \checkmark$$

$$= \frac{100\,000}{13\,600 \times 10 \left[\frac{0,008}{0,002} + 1 \right]}$$

$$= 0,147\,m \checkmark \checkmark \quad (4)$$

4.3 4.3.1



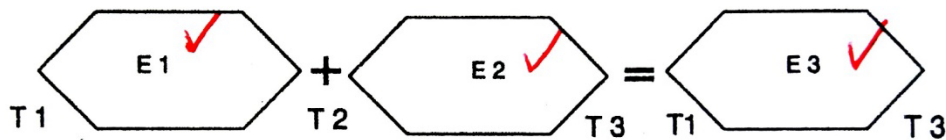
(5)

- 4.3.2
- The circuit is connected to a regulated power supply. The current flowing through the measuring cell and the reference cells will cause their elements to heat up
 - resulting in the change in resistances of the elements.
 - Since these elements are in different arms of the bridge, their increase in resistance will cancel out
 - and the bridge will remain balanced.
 - When a vacuum is connected to the measuring cell, the gas decreases, thus less heat is conducted away from the element causing the temperature to increase.
 - The resistance of the element increases resulting in the bridge being unbalanced.
 - An indicating instrument is connected across the bridge calibrated directly in vacuum units.

(7)
[20]**QUESTION 5**

- 5.1
- Celsius scale
 - Kelvin scale
- (2)
- 5.2
- A thermostat is a device (usually in the form of a convex bimetal disk) used to sense overtemperature conditions✓ and automatically shuts off power to the heater if the water temperature exceeds a pre-set limit.✓
 - A thermometer is a temperature measuring device.✓✓
- (4)

5.3



(3)

- 5.4 The resistance thermometer operates on the principle that the resistance of a metallic conductor changes linearly with temperature changes.✓✓ The resistance/temperature relationship of a typical resistance bulb is given by $R_T = R_0[1 + \alpha T]$.

Where : R_T = the resistance at some temperature✓

R_0 = the resistance at 0°C ✓

α = temperature coefficient of material [$^\circ\text{C}$]✓

T = temperature at which the resistance is required [$^\circ\text{C}$]✓

(6)

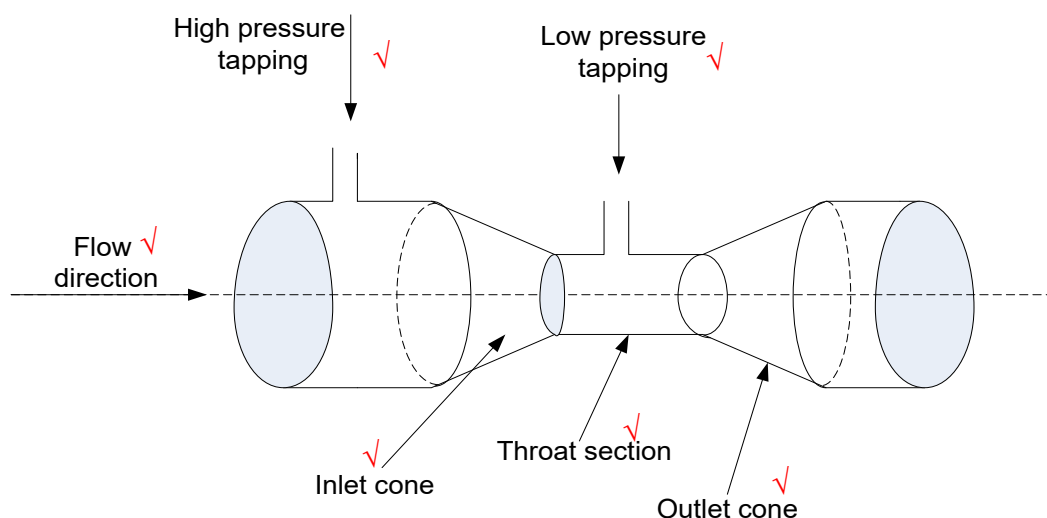
5.5 $R_T = R_0(1 + \alpha T)$ ✓
 $15 = 12(1 + 0,004 T)$ ✓
 $1,25 = 1 + 0,004 T$ ✓
 $\Rightarrow T = \frac{1,25-1}{0,004} = 62,5^\circ\text{C}$ ✓✓

(5)
[20]**QUESTION 6**

- 6.1 For a stream of ideal fluid, in a steady flow,✓ with no frictional forces involved and acting only under gravity,✓ the sum of the pressure energy, kinetic energy and the potential energy✓ is constant.✓

(4)

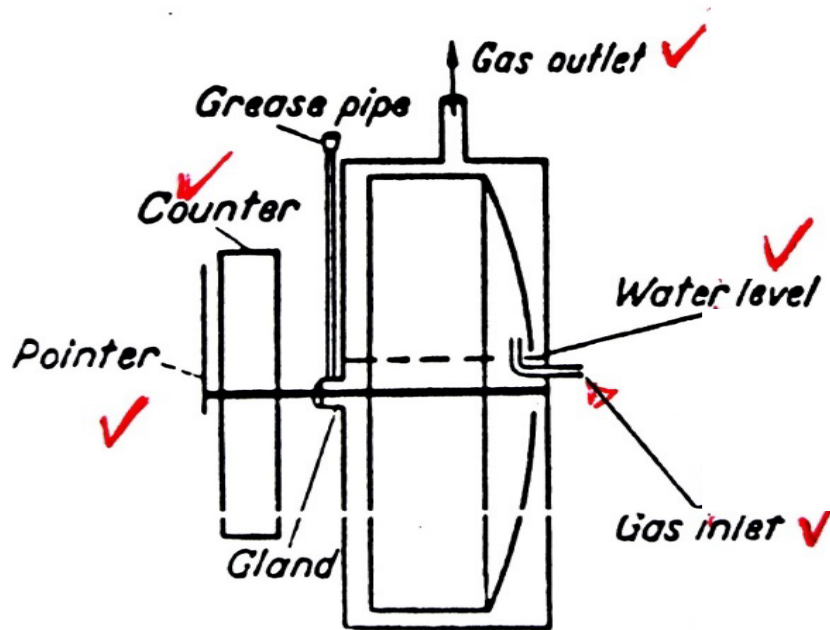
6.2



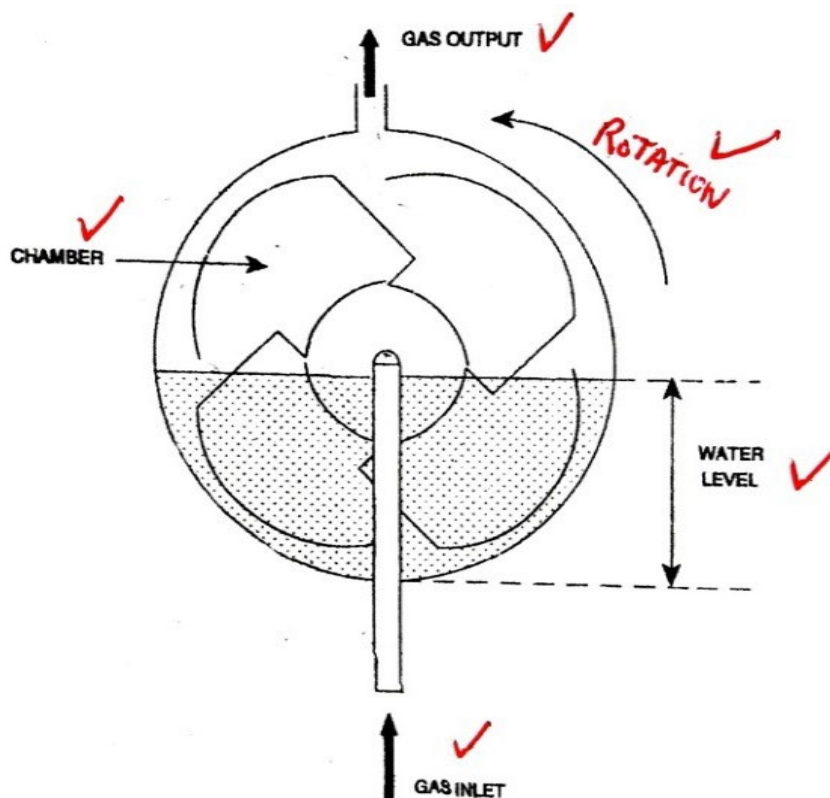
The inlet cone reduces the area of the pipe, which will increase the velocity of the flow and decrease the pressure.✓ A differential pressure is thus generated and measured.✓

(8)

6.3



OR



(5)

- 6.4
- Pressure loss is very small.
 - It can be inserted into a pipe without shutting down the pipeline.
 - It is very useful for determining actual velocity profiles.
 - Its cost is low.

(Any 3 × 1)

(3)
[20]

QUESTION 7

7.1 $\Delta P = \rho g h$

$$\Rightarrow h = \frac{\Delta P}{\rho g} \checkmark$$

$$= \frac{54,3 \times 10^3}{1\,000 \times 10}$$

$$= 5,43 \text{ m} \checkmark \checkmark$$

$$\therefore V = lbh \checkmark$$

$$= 5 \times 7 \times 5,43$$

$$= 190,05 \text{ m}^3 \checkmark \checkmark$$

(6)

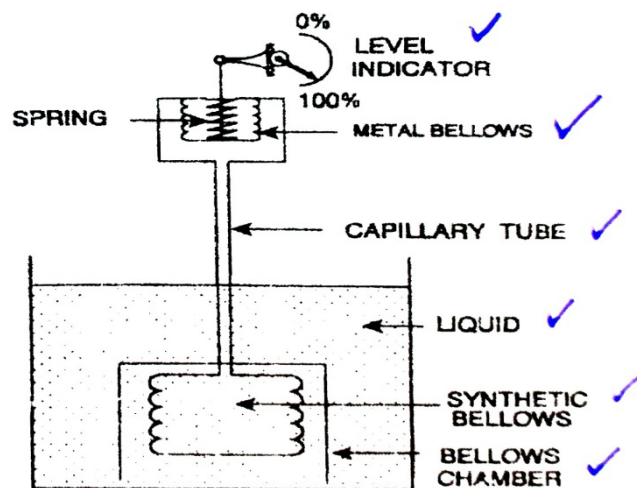
7.2 $H_L = \left[\frac{\rho_m}{\rho_L} \right] \times h - H_1 - \frac{h}{2}$

$$= \left[\frac{13\,600}{890} \right] \times 0,6 - 2 - \frac{0,6}{2}$$

$$= 89,385 \text{ m}$$

(4)

7.3



(6)

7.4 When the liquid level rises, ✓ the static pressure of the liquid increases on the bellows, compressing the air inside the bellows. ✓ Thus the pressure inside the bellows will increase ✓ and will be passed on to an indicating instrument via the capillary tube. ✓

(4)
[20]

TOTAL SECTION B: 80
GRAND TOTAL: 100