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CHEMICAL ENGINEERING

IFLOW 001011

CHE 312

ASSIGNMENT

1a. What is instrumentation?

Instrumentation refers to devices that measure or control pressure, flow, currents and speed for gas, electrical, chemical and other systems.

b. Explain succinctly the mobile and stationary phase in Gas Chromatography.

→ Mobile Phase in Gas Chromatography:

In gas chromatography, the mobile phase (or "moving phase") is a carrier gas, usually an inert gas such as helium or an unreactive gas such as nitrogen. Helium remains the most commonly used carrier gas in about 90% of instruments although hydrogen is preferred for improved separations.

## → Stationary Phase in Gas Chromatography

Stationary phase in gas chromatography is the part of the chromatographic system where the mobile phase will flow and distribute the solutes between the phases. In gas-liquid chromatography, the stationary phase is a liquid which is immobilized or absorbed on a solid support material such as silica particles.

c.) Highlight four (4) reasons why moisture measurements are germane in process industries and list four (4) methods of moisture measurement.

## → Reasons why Moisture Measurements are Germane in Process Industries:

Moisture measurements are important because:

- i.) It prevents damage or corrosion of equipment.
- ii.) It helps to prevent explosions during process.
- iii.) It helps to achieve favourable results.
- iv.) It prevents poisoning of reactions.

→ Four (4) methods of Moisture Measurement

i) Absolute Measurement method.

ii) Relative Humidity Method.

iii) Capacitance Method.

iv) Oxide Sensors.

2a. State four (4) cogent reasons for measuring and controlling process variables.

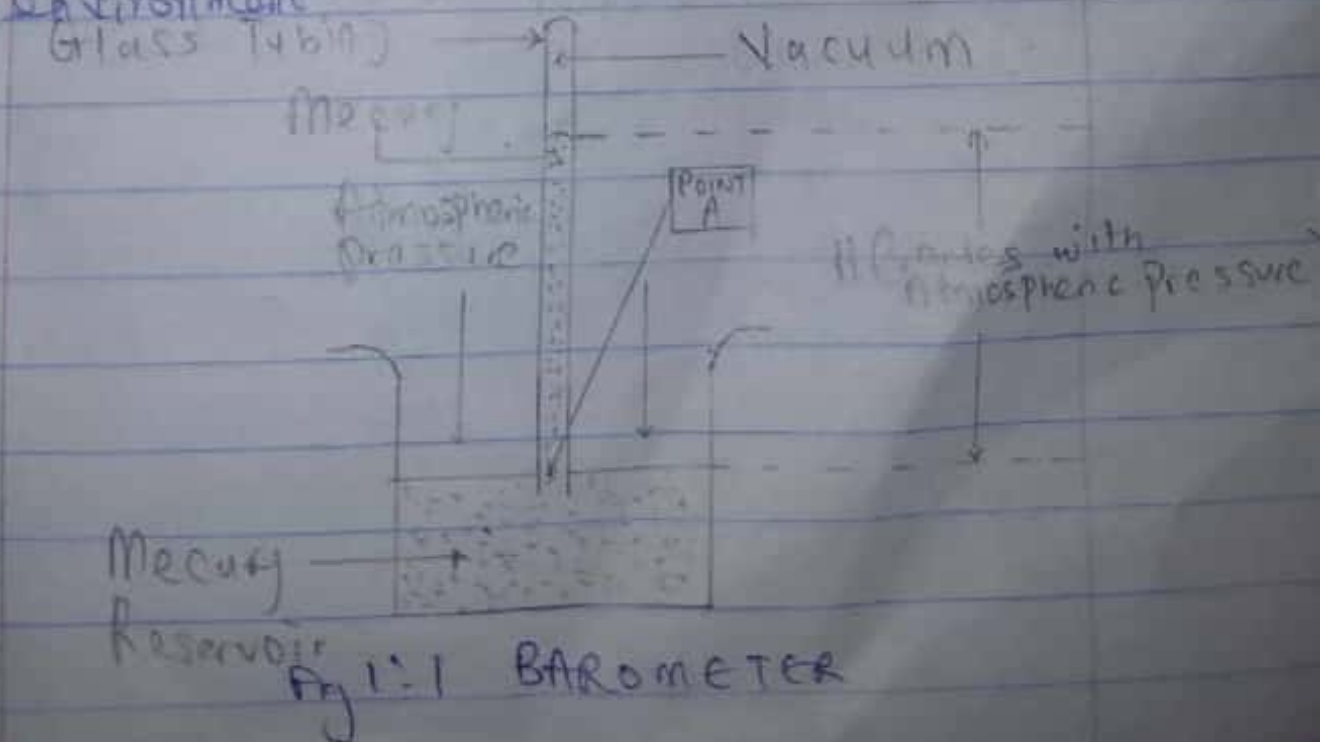
→ i) Accurate measurement of process variables is important for the maintenance of accuracy in a process.

ii) To obtain values for the current conditions with the process, and make it available in a form usable by either the control system, process operator or any other entity.

iii) It is also important to control / measure process variables to know errors encountered during the process.

narrow glass tube filled with mercury supported in a container of mercury, and the second makes use of an elastic disk whose size changes as a result of air pressure.

The principle can be illustrated as follows: a long glass tube is sealed at one end and then filled with liquid mercury metal. The filled tube is then turned upside down and inserted into the bowl of mercury, called a cistern. When this happens, a small amount of mercury runs out of the tube into the cistern, leaving a vacuum at the top of the tube. Vacuums, by nature, exert very little or no pressure on their surrounding environment.



## → Bourdon Gauge

The Bourdon pressure gauge operates on the principle that, when pressurized, a flattened tube tends to straighten or regain its circular form in cross-section. The Bourdon tube comes in C, helical, and spiral shapes. When a gauge is pressurized the Bourdon creates the dial tip travel to enable pressure measurement. The higher the pressure requirement of the application the stiffer the Bourdon tube needs to be.

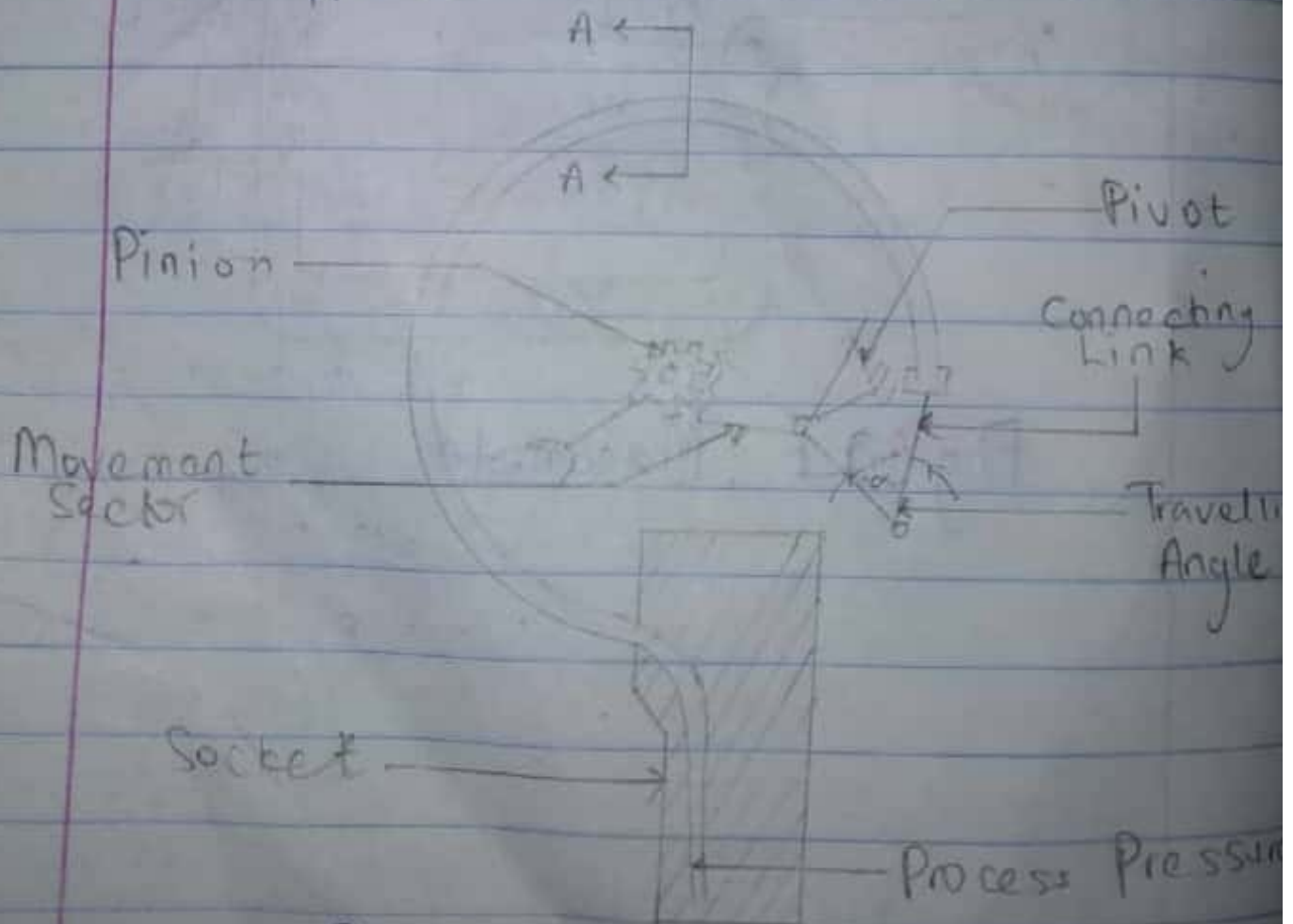


Fig 1: 3

BOURDON GAUGE

iv) We control variables to keep the variable within the given limits.

b) Magnetic flow meters are highly important in process industries. Mention three typical applications of magnetic flow meters.

→ Three typical applications of magnetic flow meters include:

- i) Metering of viscous fluids
- ii) Slurries or highly corrosive chemicals.
- iii) Process water and heavy media flows.

c) With the aid of diagram briefly describe the working principle of any three pressure measuring devices.

→ The Barometer

A Barometer is an instrument for measuring atmospheric pressure. Two kinds of barometers are in common use a mercury barometer and an aneroid barometer. The first makes use of a liquid

→ Manometers

A manometer works on the principle of hydrostatic equilibrium and is used for measuring the pressure (static pressure) exerted by a still liquid or gas. Hydrostatic equilibrium states that the pressure at any given point in a fluid at rest is equal and its value is just the weight of the overlying fluid.

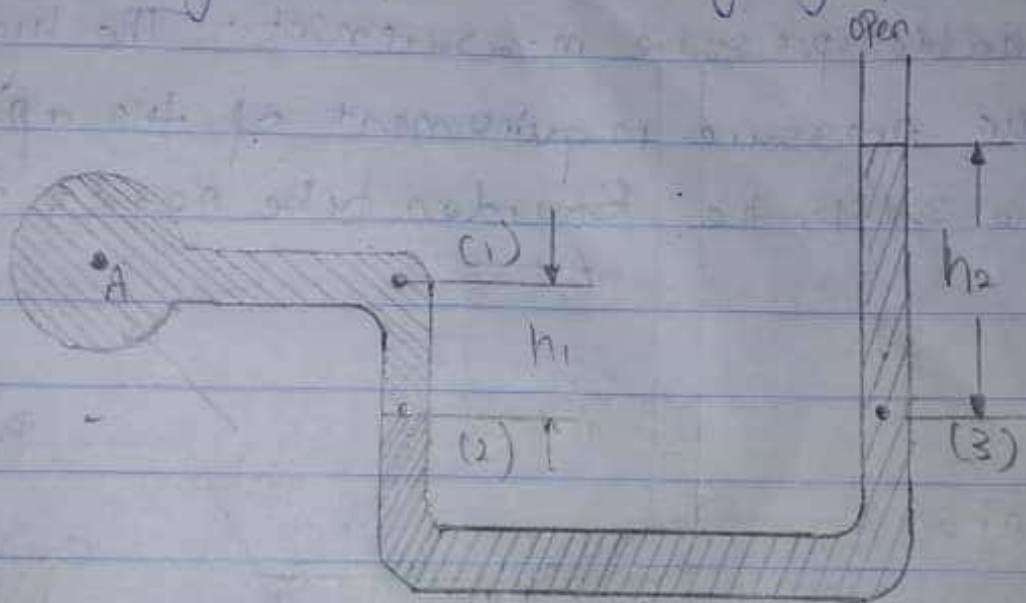


Fig 1.21 : Manometer

## References

- i) [en.wikipedia.org/wiki/process-variable](https://en.wikipedia.org/wiki/process-variable).
- ii) [en.wikipedia.org/wiki/Gas-chromatography](https://en.wikipedia.org/wiki/Gas-chromatography).
- iii) [www.flowmeters.com](http://www.flowmeters.com) → magnetic technology.
- iv) [Scienceclarified.com/AS-Bi/Barometer.html](http://Scienceclarified.com/AS-Bi/Barometer.html)
- v) [Sciencestruck.com/manometer-working-principles-types-applications](http://Sciencestruck.com/manometer-working-principles-types-applications).
- vi) [en.wikipedia.org/wiki/Bourdon-tube](https://en.wikipedia.org/wiki/Bourdon-tube).