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15/ENG07/008

CHEMICAL ENGINEERING

CHE 574: ALTERNATIVE ENERGY SOURCES

ASSIGNMENT THREE

1. Monitor the average ambient temperature between Monday 17th February and Friday 21st February 2020 and estimate the average daily thermal energy from the sun reaching land.

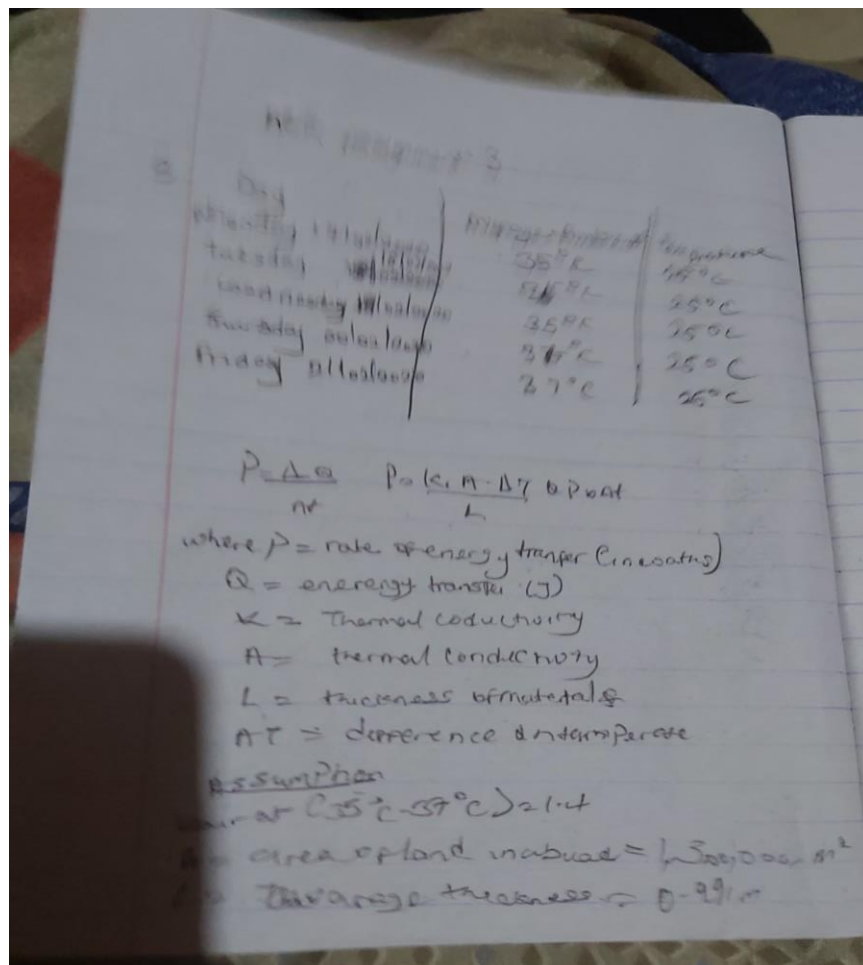


Figure 1: Part A Calc

Part B Calc

Temperature
 5°C
 5°C
 5°C
 5°C

For Monday, $\Delta T = 10^{\circ}\text{C}$

Tuesday, $\Delta T = 36.28 = 11^{\circ}\text{C}$

In the same manner we have 11°C and 12°C for others

$$\text{Monday } P = \frac{\Delta Q}{\Delta T}$$

$$\text{and } Q = P \times \Delta T$$

We get

Monday = 396700 mJ , Tuesday = 431360 mJ

Wednesday = 396700 mJ

Thursday = 436300 mJ , Friday = 470000 mJ

Hence average is given as 420460 mJ

2. With the aid of a diagram, describe the working principle of an Anemometer

Anemometer is a device for measuring the speed of airflow in the atmosphere, in wind tunnels, and in other gas-flow applications. Most widely used for wind-speed measurements is the revolving-cup electric anemometer, in which the revolving cups drive an electric generator.

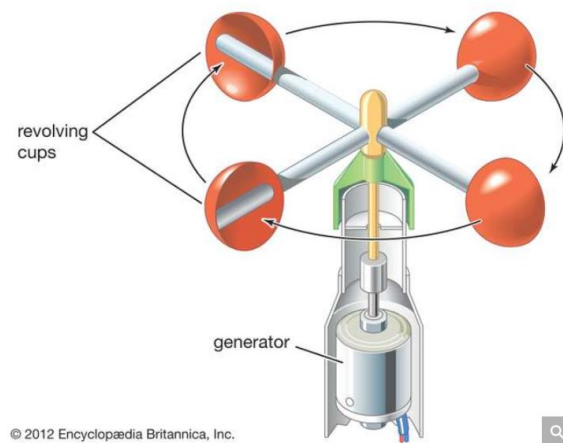


Figure 2 : An Anemometer

The output of the generator operates an electric meter that is calibrated in wind speed. The useful range of this device is approximately from 5 to 100 knots. A propeller may also be used to drive the electric generator, as in the propeller anemometer. In another type of wind-driven unit, revolving vanes operate a counter, the revolutions being timed by a stopwatch and converted to airspeed. This device is especially suited for the measurement of low airspeeds.

The fact that a stream of air will cool a heated object (the rate of cooling being determined by the speed of the airflow) is the principle underlying the hot-wire anemometer. An electrically heated fine wire is placed in the airflow. As the airflow increases, the wire cools. In the most common type of hot-wire anemometer, the constant-temperature type, power is increased to maintain a constant wire temperature. The input power to the hot wire is then a measure of airspeed, and a meter

in the electrical circuit of the hot wire can be calibrated to indicate airspeed. This device is useful for very low airspeeds, below about 5 miles (8 km) per hour. The kata thermometer is a heated-alcohol thermometer; the time it takes to cool is measured and used to determine air current. It is useful for measuring low speeds in studies of air circulation.

A stream of air striking the open end of a tube closed at the other end will build up pressure within the tube. The difference in pressure between the interior of this tube (called a pitot tube) and the surrounding air can be measured and converted to airspeed. Pitot tubes are also used to measure the flow of liquids, particularly in the course of flume studies in fluid mechanics. This anemometer is most useful, however, in strong, steady air streams, such as in wind tunnels and aboard aircraft in flight. With modifications, it can be used to measure supersonic air flow. Another type of pressure anemometer is the Venturi tube, which is open at both ends and of larger diameter at the ends than at the middle. Airspeed is determined by measuring the pressure at the constriction in the tube. Venturi tubes have some applications in industry.

3. How much energy is being produced from the dams in Nigeria?

Nigeria is the largest economy in sub-Saharan Africa, but limitations in the power sector constrain growth. Nigeria is endowed with large oil, gas, hydro and solar resource, and it already has the potential to generate 12,522 megawatts (MW) of electric power from existing plants, but most days is only able to generate around 4,000 MW, which is insufficient. Nigeria has privatized its distribution companies, so there is a wide range of tariffs.

GENERATION CAPACITY

- Installed Capacity: 12,522 MW
 - Thermal: 10,142 MW
 - Hydro: 2,380 MW
- Reached Financial Close: 3,034 MW
- Power Africa 2030 Pipeline: 11,750 MW