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Multiple choice question

1. Renewable energy is a **inexhaustible** in nature.

   a. Exhaustible. b. Inexhaustible

   c. Source. d. Resource

2. In **hydro power** kinetic energy of water is converted into electrical energy

   a. Hydropower. b. Thermal Power. C. Tidal power. d. Wind power

3. In **wind power** wind energy is converted into electrical energy

   a. Hydropower. b. Thermal Power. C. Tidal power. d. Wind power

4. In **thermal power** thermal energy is converted into electrical energy

   a. Hydropower. b. Thermal Power. C. Tidal power. d. Wind power

5. **Tidal power** the ocean energy is converted into electrical energy.

   a. Hydropower. b. Thermal Power. C. Tidal power. d. Wind power

6. Plant matter created by the process of photosynthesis is called as **biomass**

   a. Biomass. b. Gasification. c. Hydrolysis. d. Payrolysis

7. **Gasification** is the process of converting solid biomass with a limited quantity of air into producer gas

   a. Biomass. b. Gasification. c. Hydrolysis. d. Payrolysis

8. **Pyrolysis** is the thermal decomposition of biomass in the absence of oxygen

   a Biomass. b. Gasification. c. Hydrolysis. d. Payrolysis

9**. Biochemical conversion** includes anaerobic digestion to produce biogas

   a. Biochemical conversion b. Gasification. c. Hydrolysis. d. Payrolysis

10. Biomass+heat=**charcoa**l

   a. Charcoal. b. Sale gas. C. Fuel gas. d. Hot combustion products

11. Biomass and limited oxygen is equal to **fuel gas**

a. Fuel gas. b. Gasification. c. Hydrolysis. d. Payrolysis

12. Biomass and oxygen is equal **hot combustion products**

a. Charcoal. b. Sale gas. C. Fuel gas. d. Hot combustion products

13. The methane percentage inside the biogas **55 to 65**%

a. 55 to 65. b. 30 to 40. C. 10 to 20 d. 1 to 10

14. The carbon dioxide percentage inside biogas is **30 to 40%**

a. 55 to 65. b. 30 to 40. C. 10 to 20 d. 1 to 10

15. **Digestion** is biological process that occurs in the absence of oxygen and in the presence of organisms

a. Digestion. b. Hydrolysis. c. Methane formation d. Acid formation

16. **Hydrolyse** and fermentation of the the raw material in the biogas is known as acid formation

a. Digestion. b. Hydrolysis. c. Methane formation d. Acid formation

17. Acetate carbon dioxide are converted into gas mixture of methane and CO2 to by the bacteria called as methane **formation**

a. Digestion. b. Hydrolysis. c. Methane formation d. Acid formation

18. **1 kg** of dry cattle dung produces 1m cube of biomass

a.1. b.2. c.3. d.4

19. 1 kg of fresh cattle dung contains **8%** of dry biodegradable mass.

a. 8. b.2. c.10. d.14

20. **1** kg of fresh cattle dung has a volume of about **0.9 litre**

a.0.9. b.1. c.0.2. d.12

21.The ratio of chemical energy output in the dry producer gas at **15 oc**

a.15. b.20. c.45. d.28

22 The calorific value of biogas ranges from **5000-5500 Kcal/kg**

a.5000-5500. b.4000. c.6000 d.8000

23.the CN ratio cattle dung **20.8**

a.20.8. b.25. c.45. d.50

24.the biogas production Lt/kg from cattle dung is

a.**40.** b.32. c.142. d.90

25.The remaining indigestible matter is reffered as **slurry**

a.slurry. b.dung. C.wet material. d.soil

26.Typical retention of slurry in a biogas plant is **40 days**.

a.40. b.50. c.80. d.60

27.Methane bacteria work best in a temperature range of **35 to 38 o C**

a.35- 38. b.56. c.40. d. 60

28.Fermentation of raw cow dung can takes place at any temp.between **8 to 55 oC**

a.8 to 55 oC. b.56. c.40. d. 60

29.The rate of biogas formation is very slow at **8 oC**

a.8. b.3. c.10. d.9

30.A Ph value between **6.8 and 7.8** must be best for normal gas production

1.6.8 - 7.8. 2.6.0. 3.9.0. 4.3.5

31.the water content should be around **90 percent** of the wt of total contents..

a.90. b.70. c.80. d.50

32.Cow dung process well if the slurry contain **8 & 9** percent solid organic matter during fermentation

a.8-9. b.10. c.20. d.22

33.The slurry should be **agitated** to improve the gas yield

a.agitated. b.dry. c.dehydrated. d.none

34.The depth of digester of KVIC **3.5- 6.5 m**

a.3.5-6.5. b. 5. c. 8. d.7.8

35.The diameter of KVIC is **1.2 to 1.6 m**

a.1.2 - 1.6. b. 4. c.3. d.2.4

36.Through the dung is mixed with water **4:5**

a. 4:5. b.8:9. c 1:3. d.2:3

37.The gas pressure varies between **7 and 9** cm water column

a.7 - 9. b. 10. c. 12 d.14

38.The cost of drum is about **40 percent** total cost of plant.

a.40. b. 50 . c.70 d.30

39. The design of the plant of **janatha typ**e is Chinese origin

a. Chinese. b. Indian. c. Spanish. d. Italian

40. In **Janata type** biogas plant no steel is used

a. Janata. b. Kvic. c. Deenbandhu . d. Lokmangal

41. Dinbandhu model was developed in **1984**

a. 1984. b. 1987. C. 2000. d. 1980

42. Deenbandhu plant having a capacity of **2** m cube/day

a.2. b.5. c. 7. d.8

43. About 90% of the biogas plants in India are of the **deenbandhu** type

a. Janata. b. Kvic. c. Deenbandhu . d. Lokmangal

44. Biogas plant can run **2** HP engine for 1 hour

a.3. b.2. c.5. d.1

45. Biogas plant can run **100 litre** capacity refrigerator for 9 hour

a.100. b.500. c 490. d. 2000

46. 1 cubic metre of biogas plant illuminate a lamp having **60 watt** capacity for 7 hours

a. 60. b.90. c.10. d.300

47. 1 cubic metre biogas plant can develop **1.25 kwh**

a.3. b.2. c.1.25. d. 1

48. Lifespan of the kvic type plant is **30 years**

a.30. b 45. c. 50. d.34

49. Fixed bed gasifier in generally a **vertical reactor**

a. Vertical. b. horizontal. c. triangular. d. Circular

50. In **updraft gasifier** at the top material at the top and the Air release from the bottom to the top

51. In a **cross draft gasifier** air is fed into the gasifier through a horizontal nozzle

52. In a **down draft gasifier** the biomass is fed the top and producer gas and ash moves down

53. The first zone of the gasification process is known as **drying**

a. Drying. b. Payrolysis c. Oxidation. d. Reduction

54. The second zone of the gasification process is known as **pyrolysis**

a. Drying. b. Payrolysis c. Oxidation. d. Reduction

55. Third zone of the gasification process is known as **oxidation**

a. Drying. b. Payrolysis c. Oxidation. d. Reduction

56. IV zone in the gasification process is known as **reduction**

a. Drying. b. Payrolysis c. Oxidation. d. Reduction

57. Pyrolysis zone temperature ranges from **200 degree Celsius to 600 degree Celsius**

a.200-600. b.120. c.900-1200. d.1300-800

58. In drying on temperature is up to **120 degree Celsius**

a.200-600. b.120. c.900-1200. d.1300-800

59. In oxidation zone temperature in this from **900 to 1200 degree Celsius**

a.200-600. b.120. c.900-1200. d.1300-800

60. In reduction zone temperature reduces from **1300 to 800 degree Celsius**

a.200-600. b.120. c.900-1200. d.1300-800

61. The process of briquetting consists of applying pressure to mass of particles with or without binder

62. Most of the agroforestry biomass contains high moisture **18 to 20%**

a.18-20. b.26. c.44. d.10

63. The compression ratio of approximately **7 : 1** for the loose biomass to form brequttres

a.7:1. b.1:2. C.5:6. d.5:6

64**. Bricquetting** is a technology method to compressing bulk raw material

65. Biomass is semi-fludized through the application of high pressure in the range of **1200 to 2000** kg per centimetre square

a.1200-2000 b.100-200 c.22-80. d.none

66. Briquetting machine operate at lower pressure range **500 to 1000** kg per centimetre square

a.1200-2000 b.500-1000 c.22-80. d.none

67. Biomass is force through the holes in a die plate by pressure rolls is called as **pelleting**.

a.pelleting. b.cutting. c.rolling. d.extruding

68. Modified from pelleting product for the size 2to5 CM is called **cutting**

a.pelleting. b.cutting. c.rolling. d.extruding

69.where biomass is forced through the holes using A screw is called **extruding**

a.pelleting. b.cutting. c.rolling. d.extruding

70.where biomass is wrapped around the rotating shaft with producers high-density roll is called as **rolling.**

a.pelleting. b.cutting. c.rolling. d.extruding

71.**sun** is the heaviest body of the solar system around which all the planets revolve

72. The light emitted from the sun reaches the earth in 8.3 minutes

73. **Sun** is the main source of heat and light energy for all the members of solar system including the earth

74. **Pyrheliometer** is used for measuring beam radiation

a.Pyrheliometer. b.anemometer. C.Pyranometer. d.Lux

75. **Pyranometer** is used to measure total radiation

a.Pyrheliometer. b.anemometer. C.Pyranometer. d.Lux

76. **Anemometer** is used to measure wind speed

a.Pyrheliometer. b.anemometer. C.Pyranometer. d.Lux

77. **Lux** is the unit of the light

a.Pyrheliometer. b.anemometer. C.Pyranometer. d.Lux

78. This solid materials in the presence of a temperature difference of heat is called as **conduction**

a. Conduction. b. Radiation . c. conviction. d. Convection

79.**radiation** in which energy moves in space by electromagnetic waves in a moving field

a. Conduction. b. Radiation . c. conviction. d. Convection

80. **Convection** means the heat is transferred from different phases

a. Conduction. b. Radiation . c. conviction. d. Convection

81. The temperature attained on a parabolic concentrator reflector is **100 to 300 degree Celsius**

82.the most favourable orientation of a collector for heating only is due to south at an inclination angle to horizontal equal to the **latitude + 15 degree**

83. **A passive method** is one in which thermal energy flows through a living space by natural means without the help of a mechanical device

84.The size of the box type cooker is **50x50x12**

a.50x50x12. b.60x60x20. c.none d.100x100x20

85.The dimensions of the latest model are.

a.50x50x12. b.**60x60x20.** c.none d.100x100x20

86.The temperature attained is ahout **100 oC** in solar coocker

a.190 b. 100. c. 15-20. d.None

87.Addition of single glass glass reflector **15-20 oC**

a.190 b. 100. c. 15-20. d.None

88.Deliver hot hoter renge of **50 to 70 oC**

a.190 b. 50-70. c. 15-20. d.None

89.A solar heater works on a principal on **natural circulation**

a. Natural circulation. b.heated. c.drying. d.none

90.Removal of moisture at predetermined level is called **dring**

a.drying. b.dehydration. c.none. d.sorting

91.Removal of moisture at dry bone condition

a.drying. b.**dehydration**. c.none. d.sorting

92.A cabinet type solar dryer is suitable for **small** scale use.

a. Small. b.large. c. None. d. Not used

93.For **large** scale drying convective dryer is used.

a. Small. b.large. c. None. d. Not used

94.In cabinet dryer drying temperature from **50- 80 oC**

a.50-80. b.10. C 19-24. d.15-20

95.Cabinet dryer drying time ranges from **2-4 days**

a.2-4. b.5. c.01. d.7-8

96. **Basin type** solar stills are adopted for distillation of water

a.basin type. b. Cabinet. c. Convective. d.none

97.A well designed still capacity is **3 lit/m2**

a.3. b.2. c.6. d.5

98.A **solar pond** is a simple device for collecting and storing heat

a.basin type. b. Cabinet. c. Convective. d.solar pond

99.**A solar pond** designed to reduce convective and evaporative heat loss .

a.basin type. b. Cabinet. c. Convective. d.solar pond

100. In a **solar pond** greater Salt concentration at the bottom

a.basin type. b. Cabinet. c. Convective. d.solar pond

101. **convective solar pond** reduces heat loss by being covered a transparent membrane

a.basin type. b. Cabinet. c. Convective solar pond d.none

102.**Non convective solar ponds** prevent heat loss by convective forces ..

a.basin type. b. Cabinet. c.non Convective. d.none

103.In a **non convective** ponds may be stabilized by viscocity

a.basin type. b. Cabinet. c.non Convective. d.none

104.The salt gradient pond is the most common type of **non convective** solar pond.

a.basin type. b. Cabinet. c.non Convective. d.none

105. A solar pond is mass of shallow water about **1-1.5 m**

a.0.5. b.1- 1.5. c.2.5. d.5

106. In a **solar pond salt** have been dissolved at a higher concentrations

107. In a solar pond **solar radiations** entering the pond surface is observed through out the depth

108.The top layer of the solar pond is **convective**

a.convective. b.non convective. c.high concentration d.none

109. The bottom layer of the solar pond **is convective layer**

a.convective. b.non convective. c.high concentration d.none

110. The middle layer of the solar pond is **non convective layer**

a.convective. b.non convective. c.high concentration d.none

111. **solar fencing** is the modern days alternative to the conventional type of perimeter protection

112.the conventional types of fenses are only **passive fences** cannot resist the intruder

113.The **solar fence** is scientific fence and works on the solar energy with backup facility

114. The heart of power fence is the **energizer**

115.the solar water pumping system is **a standalone** system operating on a power generated using solar PV system

116**.the winds** on the earth surface are caused by the unequal heating of the land and water by the sun

117. Energy derived from wind velocity is **wind energy**

118.**wind energy** is non conventional type of energy which is renewable with suitable devices

119.the minimum wind speed of **10 km per hour** is considered to be useful for working windmill for agriculture purpose

120. The **wind energy** vary from time to time and place to place.

121. In India win speed lies between **5 kilometre per hour to the 20 km per hour**

a.5-20. b.10-30. c.none of these. d.4

122. Windmill is a machine for **wind** energy conversion

a.wind. b.water. c.Velocity. d.kinetic

123. **Vertical Axis machine** simple design as compared to horizontal express

124. **Savoni windmill** works on the principle of cup anemometer

125.**horizontal Axis wind turbines** have their axis of rotation horizontal to the ground

126.the **horizontal type windmill** have a 3 cross section or more efficiently thick cross-section to the blade

127. In windmill rotors **more than two** blades would have higher coefficient

128**.biofuel** transportation fuel like biodiesel that are made from biomass material

129. **Viscosity** representation flow characteristics and the tendency of fluids

130. **Density** represents weight per unit volume.

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1) The gas thus produced was and is still called as **Marsh Gas**.
2) The Technology of harnessing this gas under artificially created condition is known as **Biogas Technology** .
3) One biogas unit for small family requirement about **3- 5** cattle heads.
4) Optimum quantity of dung with water mixture in **First** stage is hydrolysised .
5) **Acid formation** contain hydrolysised mixture is converted into acid mixture.
6) **Methane generation** is the acid mixture converted into mechanization stage.
7) Methane forming micro organism is also known as **Methanogens.**
8) Biogas contain tolerated PH range is **6.8 to 7.5.**
9) **Three** zones are present in anaerobic fermentation of organic matter.

10) The optimum temperature of digester slurry in mesophillic, Thermophilic, Psycrophilic **is 35,55, 10.**

11) PH range suitable for gas production is rather narrow **i.e 6.6 to 7.5.**

12)C:N ratio is usually around **25:1.**

13)The optimum levels for cattle dung slurry in the range of **8 to 10%**

14)A combination of batch feed and semi continous fed digester is known as **SHF digestion.**

15)The year **1961** khadi and village industries commission(KVIC).

16) The Janata model is a mixed dome biogas plant which was developed by PRAD in 1978.

17)The Janata plant costs about **20-30%** less than the KVIC floating drum type plant.

18)**Deenbandhu plant** is modification and advnce version of Janata fixed dome biogas plant.

19)**Gasification** is the process of converting solid biomass with limited quantity of air into producer gas.

20)Maximum limit of **5-15** mg solid and tar per kg of gas may be allowed for the use of gas in on IC engine.

21)Raw material includes **agricultural residues common solid waste.**

22)In **forestry** product hagging,chipping, d**r**ying,densifying operation carried out.

23)Municiple solid waste size reduction of MSW is done by **one or two stages** shredding only.

24)Ferromagnetic and non-ferromagnetic metals separated by **Eddy current.**

25)Glass pieces are removed by **Air classification**.

26)Fixed bed gasifer is generally a **vertical rector (Furance).**

27) The fixed bed gasifer are the feedstock is supported either on fixed **grate or sand bottom**.

28) The first zone of gasification is **drying zone.**

29) Temperature of drying zone is **120 c.**

30) Second zone of gasification is **pyrolysis zone.**

31) Temperature of pyrolysis is **200-600 c.**

32) Third zone is called **oxidation or combustion zone.**

33) Temperature of oxidation zone is **900-1200 c .**

34) Fourth zone is called **as reduction zone.**

35)Temperature of reduction zone is **900-600°c**

36)Heating value of producer gas ranging from **4000-5000 kg/m^2**

37)**Downdraft gasifer** produces relatively cleaner gas.

38) **Fluidized bed** gasifer is refractory lined unit.

40) Conversion efficiency of gasifer **is 75%.**

41)**Drying** is a universal method for preserving food.

42)Food become lighter due to **moisture removal.**

43)Dried product not only has increased shelf life but also reduce cost of **transportation and storage.**

44)**Traditionally** food products are dried by spreading in open sun in tin layer.

45)Spreading the food product in open sun in tin layer, this method is known as **natural or open sun drying.**

46) The removal of moisture require only **low temperature heating.**

47)In the **forced circulation** type solar dryer ,air is heated through collector and is forced on to the drying material.

48)Dryers are classified as **direct** as well as **indirect** type of solar dryer.

49)The intermittent nature of solar radiation cannot affect the drying the performance at **low temperature.**

50)Photovoltics (PV) or solar cell are often referred to semiconductor devices that convert sunlight into **direct current (DC) electricity.**

51)Group of PV cell are electrically configured into **modules and arrays.**

52)PV system can be used either **centralized or distributed** power generation.

53)Energy independence and environmental compability are two attractive feature of PV system.

54)At present the high cost of **PV module and equipment** is the primary limiting factor for the technology.

55) A typical silicon PV produce about **0.5 – 0.6** volt DC under open circuit, no wood condition.

56) A **PV cell** is a fundamental building block of PV system.

57)A PV array produce energy / power when exposed to **sunlight.**

58)A **PV array** is a complete power generating unit consisting of any no. of PU module and panel.

59)Winds are the motion of **air** around the earth.

60)The moment of air is caused by the **uneven heating** of the planers surface by the sun.

61)Scientist have estimated that as much as **10%** of worlds electricity could be provided by wind generation.

62)India has estimated wind power potential of **45,195 MW.**

63)India ranks **fourth** in the world in wind power generation.

64)In India more than **7660 MW** of electricity is being produced from the wind energy .

65)The world largest wind forms are in **California.**

66)The first wind mill used as source of electric power was built in **Denmark** in **1890.**

67)The major factor influencing energy in the wind is the **wind velocity.**

68)The wind energy is very **diffuse** in nature.

69)Doubling the wind speed will increase the available power **Eight** times.

70)The efficiency of wind machine depends on **wind speed** with type of turbine and with nature of load.

71)At the **furling speed (VF)** the machine is shut down to protect from high winds.

72)**Seasonal and diurnal** variation has significant effect on wind.

73)Diurnal variation is less than increase in **height.**

74)Wind speed inceases with **increase** in height.

75)The rate of increase is given by **V/V0=(H/HO)1/2.**

76)Wind energy conservation system are divided into two types **horizontal axis machine and vertical axis machine.**

77)The size of wind pumps currently available ranges

From **1 to 8m** rotar diameter.

78)Battery charger of rating **1.5 kw to 4 kw** are available.

80)The wind been used as a **reliable and inexpensive** power source for water pumping.

SECTION – III

Part 1: Renewable Energy Sources

Renewable resources are more evenly distributed than the fossil and nuclear and possible energy flows from renewables are more than three orders of magnitude higher than the current global energy use.

However, the economical exploitation of the renewables is dependent upon many factors like competing land use, interruptible nature of resources like solar radiation and wind patterns and the cost of harnessing the resources.

While the costs of installation and generation of electricity with renewable sources continue to decline and technological advances improve generation efficiencies, historically they have not kept pace with the economics of energy from fossil fuels.

OBJECTIVE QUESTIONS

1. The source of energy which, can be renewed by reproduction or by physical processes is known as ……. source of energy

[Renewable or Inexhaustible]

2. Typical examples of ……. energy sources are human, animal, solar, wind, biomass and manure.

[Renewable]

3. Renewable sources of energy are…….

[Inexhaustible]

4. ……. sources of energy can be renewed by Chemical process, Mechanical process & Reproduction.

[Renewable]

5. Renewable energy sources are constantly ……. by nature

[Reproduced]

6. Renewable energy as source of farm power includes…….

[Solar, wind & biogas]

7. Renewable energy is mainly obtained by …….

[Sun, wind & biomass]

8. The …… is a source of all energy sources.

[Sun]

9. Energy sources that take long time to be replenished are called as ……. source of energy.

[Non-renewable or exhaustible]

10. Typical examples of ……. energy sources are crude petroleum, coal and natural gas.

[Non- renewable]

11. …….is energy obtained from static stores that remain bound unless released by human interaction.

[Non renewable]

12. Traditional energy is associated with to …….

[Drying of clothes]

13. Energy sources that release available energy directly to the system through chemical or biological process called as ……. source of energy.

[Direct]

14. Typical examples of ……. source of energy are human labour, animal labour, biomass, petroleum products and electricity.

[Direct]

15. Energy sources that do not release energy directly but it release through conversion process called as ……. source of energy.

[Indirect]

16. Typical examples of ……. source of energy are seed, manures agro-chemicals, fertilizers and machinery.

[Indirect]

17. The energy sources are available at low cost called as ……. sources of energy.

[Non-commercial]

18. Typical examples of non-commercial sources of energy are ……. and …….

[Human & bullock]

19. Typical examples of ……. sources of energy are diesel, petrol and kerosene.

[Commercial]

20. The sun generates energy from…….

[Nuclear fusion]

21. The …….source of energy is solar system, wind & water.

[Inexhaustible]

22. Water is the ……. source of energy.

[Inexhaustible]

23. The ……. fuels are coal, oil & natural gas.

[Fossil]

24. The commercial source of energy is mostly …….

[Fossil fuel]

25. Agricultural waste is the ……. source of energy.

[Non commercial]

26. Wood is the mixture of compounds, like…….

[Cellulose]

27. ……. energy is initially an isolated energy potential.

[Non renewable]

28. …….energy supplies are also called Finite supplies or Conventional energy supplies.

[Non renewable]

29. Wind, solar, biomass and tidal are examples of ……. energy supplies.

[Renewable]

30. Solar, biomass, geothermal, wind and hydropower energy are all renewable sources of energy. They are called renewable because they can be ……. by nature in a short period of time.

[Replenished]

31. Coal, petroleum, natural gas and propane are because they are formed from the buried remains of plants and tiny animals …….

[Fossil fuels]

32. The most commonly used renewable energy source in the world is……. energy.

[Hydro]

33. Hydrogen energy accounts for about…….

[23%]

34. The concentration of CO_2 in atmosphere is…….

[0.03%]

35. Global warming focuses on an increase in the level of gas in the

atmosphere…….

[Carbon dioxide]

36. Burning oil produces ..... gas said to be causing global warming.

[Carbon dioxide]

37. Environmental pollution is not caused by……. in atmospheric air.

[High humidity content]

38. The primary energy consumption of India is ……

[1/29 of the world]

38. The global primary energy consumption (2002) was equivalent to ……

[9405 Mtoe]

39. The world average per person energy consumption is equivalent to …… tonnes of coal.

[2.2]

40. The fuel dominates the energy mix in Indian energy scenario? ……

[Coal]

41. The fourth largest producer of coal and lignite in the world is ……

[India]

42. Indian per capita energy consumption is …… of the world average.

[20%]

43. India's energy intensity is …… times of world average.

[1.5]

44. India's current percentage peak demand shortage for electricity is …… **(EM/EA)**

[14%]

45. Energy consumption per unit of GDP is called as ……

[Energy intensity]

46. …… the Act, which is proposed to bring the qualitative transformation of the electricity sector.

[Electricity Act 2003]

47. Which of the following is highest contributor to the air pollution?

[Carbon Monoxide]

48. Projected temperature increase in degree centigrade 2100 due to climate change is ……

[2]

49. Acid rain is caused by the release of the following components from combustion of fuels.

[SOx and NOx]

50. The fundamental process now in general use for conversion of solar radiation into heat is the ……

[Green house effect]

51. According to US geological survey, geothermal energy is all heat stored in the Earth's crust above 15 ^{0}C to a depth of ……

[At 10 km]

52. In India the states of Himachal Pradesh, Karnataka and Jammu & Kashmir has …… plants.

[Geothermal]

53. World oil reserves are estimated to last over ……

[45 years]

54. The country has the largest share of the global coal reserves ……

[USA]

55. The % of gas reserves for Russian Federation, when compared to world reserve is considered at ……

[30 % of World reserve]

56. World gas reserves are estimated to last over ……

[65 years]

57. There are no nuclear fusion power stations in world because Nuclear fusion is …….

[Hard to control]

58. Today, which renewable energy source provides the U. S. with the most energy……

[Hydropower]

59. The U. S. consumes lots of energy. The fuel provides the most energy……

[Petroleum]

60. The sector of the U.S. economy consumes most of the nation's petroleum……..

[Transportation]

61. The most of energy in American homes used for …… the rooms.

[Heating and cooling]

62. The first hydro electric power plant in the U. S. was built in…….

[1982]

63. The most widely used fuel ……. at the U.S. electric plants.

[Coal]

64. Most car runs in U.S. run on…….

[Gasoline]

65. Bernoulli's principle is based on the law of conservation of…….

[Energy]

66. The temperature to which a vapour gas mixture must be cooled (at varying humidity) to saturate is…….

[Dew point]

68. Hot wire anemometer is a device used to measure…….

[Gas velocities]

69. A chromatograph is used for analyzing the ……. of a gas.

[Composition]

70. The most common gas employed in gas chromatograph is…….

[Helium]

71. Orsat apparatus is used for……. analysis of the flue gas.

[Volumetric]

72. Geysers is example of…….energy

[Geothermal]

73. Electrical current is produced from at……. power stations.

[Electric]

74. Approximately when did the power stations appear…….

[1950]

75. Electric current is carried in the wires by…….

[Electrons]

76. In the turbine generator electrical energy is produced from…….

[Mechanical energy]

77. The electric bulb emits light because the filament ……. gets hot.

[Inside]

78. A positive and negative particles…….

[Attract]

79. Name of the Metal in which Electrical current is better conducted by…….

[Copper]

80. Two positively charged particles…….

[Repel]

81. Electric motors normally consumes …….

[Electric energy]

82. Two negatively charged particles …….

[Repel]

83. What type of electric current is most commonly used to transmit electricity?

[AC]

84. Electric wires normally carry …….

[Electric current]

85. How static electricity can be produced by rubbing a …….

[Wool cloth]

86. Electric generators normally produce …….

[Electric current]

87. The material ……. is not normally used to produce electricity.

[Plastic]

88. Volt is a unit of…….

[Electric potential]

89. Nuclear submarines run on…….

[Uranium]

90. Most jet planes use ……. to fly.

[Kerosene]

91. A flywheel stores ……. energy.

[Kinetic]

92. The space shuttle uses……. to burn fuel.

[Liquid oxygen]

93. Green plants convert solar energy into ……. energy.

[Chemical]

94. The energy source is used by the sun use for energy generation…….

[Nuclear energy]

95. Cell phone batteries convert ……. energy into electricity.

Chemical]

96. The fuel used in ships…….

[Oil based]

97. Don't warm up the engine for too long. One ……. is plenty for most cars even when it's too cold outside.

[Second]

98. Don't waste money on ……. gasoline if the car manufacture doesn't require it.

[Premium]

99. When idling, cool down the automatic transmission by putting it in …….

[Neutral]

100. Don't tailgate. Tailgating means frequent breaking and accelerations which ……. It's also unsafe.

[Waste fuel]

101. Lighten up the car. Every extra 100 ……. may reduce the car's fuel economy by 2%.

[Pounds]

102. Remove ……. if you don't need it. You may improve your fuel economy by 5%.

[Roof rack]

103. Think ahead for example, ……. before a hill, not while driving uphill.

[Accelerate]

104. Keep the tyre pressure at the maximum recommended by the manufacturer. ……. tyres cause additional drag on the car and reduce fuel economy.

[Under – inflated]

105. If one park for at least 30 seconds, ……. the engine. Restarting the engine costs about as much as 30 seconds of idling.

[Turn off]

106. Don't push the gas pedal too hard. Hard acceleration and frequent braking are some of the biggest …….

[Gas wasters]

107. Don't speed an extra 20 mph beyond ……. mph may cost you as much as 20% in fuel economy.

[55]

108. Replace the air filter. A ……. air filter may cost you as much as 20% in fuel economy.

[Dirty]

109. A household iron consumes about ……. of energy in 1 hour.

[1 kW-h]

110. 3,600,000 joules equals to…….

[1 kW-h]

111. Electric bills are usually based on energy consumption measured in …….

[kWh]

112. One Calorie equals to …….

[4.186 joules]

113. A 100 W light bulb consumes ……. in 24 hours.

[2.4 kWh]

114. One food calorie equals to …….

[1000 calorie]

115. In nuclear physics, what is unit of energy?

[Electron volts]

116. One BTU equals about …….

[0.293 Watt hours]

117. An average apple contains about ……. of food energy.

[100 Calorie]

118. To raise temperature of 1 gm of water by 1 degree Celsius, one need …….

[1 Calorie]

119. One kWh equals to …….

[1000 Watt hours]

119. Burning 1 gallon of gasoline produces ……. of energy.

[35 kWh]

120. The electron volt, calorie & watt hour are used to measure …….

[Energy]

121. The metals and minerals obtained from the earth are the……. source of energy.

[Exhaustible]

122. The total emission of radiant energy from a black body takes at a rate expressed by the ……. law.

[Stephan – Boltzmann]

123. Cyclone filter is useful for …….

[5 micrometer]

124. A body which at any one temperature emits the maximum possible amount of radiation is known as…….

[Black body]

125. Brasses are the alloys mainly of ……

[Cu & Zn]

126. The range of temperature underneath the earth's thin crust is ……

[1000 to 4000]

127. The molten rock called at temperature from 700 – 1600 ^{0}C is ……

[Magma]

128. Ministry of Non renewable Energy Sources (MNES) created in …… year.

[1992]

129. The National project on biogas development was initiated in …… year.

[1981 – 1982]

130. In …… National Programme on Improved Chulhas (NPIC) was launched.

[1986 - 1987]

131. N.T.P.C. stands for ……

[National Thermal Power Corporation limited]

132. N.H.P.C. stands for ……

[National Hydro Electrical Power Corporation]

133. N.H.P.C. was set in …… year.

[1975]

134. W.R.R.R.S stands for ……

[Waste recycling and resources recovery system]

135. N.P.B.D. stands for ……

[National project on biogas development]

136. ONGC stands for ……

[Oil & Natural Gas Corporation]

137. OIL stands for ……

[Oil India Limited]

138. The proportion of the incident solar radiation reflected from the surface is called ……

[Albedo]

139. Compressed Natural Gas (CNG) consists about …… methane (CH_4) and rest ethane and propane.

[95%]

140. It is estimated that …… of land having energy plantation can support power generation of ……

[1000 ha, 3 MW]

141. The law of …… says that energy is neither created nor destroyed.

[Energy conservation]

142. The amount of useful energy converted into work which is obtained from a system is ……

[Energy efficiency]

143. The upper layer of the convective zone is called ……

[Photosphere]

144. The temperature of the chromosphere is about at the base ……

[4500 K]

145. Michael Faraday builds as electric generator in …….

[1831]

146. Robert Anderson builds one of the first electric vehicles in…….

[1839]

147. Edison and Swan patent the carbon thread incandescent lamp in…….

[1879]

148. Michael Faraday invents an electric motor in …….

[1821]

149. James Watt patents an improved steam engine in …….

[1769]

150. First U. S. patent for an electric motor issued to Thomas Davenport in …….

[1837]

151. William Robert grove builds the first fuel cell in…….

[1838]

152. Westinghouse and Stanley install the first AC power system in …….

[1886]

153. Westinghouse Shallenger developed an electric power meter in …….

[1888]

Part 2: Solar Energy

World Solar Energy Scenario:

The earth continuously receives a power input of 1.73×10^{14} KW from the sun. This translates to 1.5×10^{18} Kwh/year, which is about 10,000 times the world is current annual energy consumption.

The current maximum solar energy potential is placed at over 2000 MTOE per year.

Solar energy in India:

India receives solar energy equivalent to over 5000 trillion kWhr/year, which is far more than the total energy consumption of the country. The daily average solar energy incident over India varies from 4-7 kWhr/m^2 depending upon the location.

In India there are about 300 clear sunny days in a year and solar energy is widely available in most of the parts. Solar PV technologies offer a unique decentralized option for providing electricity locally. The SPV technologies programme is aimed to develop the cost effective PV technologies and its application for large-scale diffusion in different sectors, especially in rural and remote area. The following PV technologies are available for wide diffusion.

1. Solar Street lighting system, solar lantern, home lighting system.
2. Stand alone PV power plant
3. Solar PV water pumping for agriculture use.

The PV of about 58 MW aggregate capacity (about 750000 systems) has been installed for various applications in the country. In India up to now, nearly 3,05,000 solar lanterns; 1,30,000 home lighting system; 40,000 streetlights and 3,450 water pumping systems have been installed.

Application of solar energy:

- Heating and cooling of residential building.
- Solar water heating.
- Solar drying of agricultural and animal products.
- Solar distillation on a small community scale.
- Salt production by evaporation of seawater or in land brines.
- Solar cooker.
- Solar engineering for water pumping.

- Food refrigeration.
- Bio conversion and wind energy, which are indirect, source of solar energy.
- Solar furnaces.
- Solar energy: thermal electrical conversion.
- Solar green houses.
- Agricultural and industrial process heat.
- Solar photovoltaic cells which can be used for conversion of solar energy directly into electricity or for water pumping in rural agricultural purposes.

Advantages:

- Solar energy is a kind of universal, decentralized, non-polluting and freely available energy source.
- Solar energy is the energy of the sun, which reaches earth in the form of short wave radiation, visible light and near ultra violate light.
- Solar energy is essential for energy kind of living organism.
- It is in-exhaustible source of energy & can be harnessed through different simple routes.
- Its availability and total potential is not confined to a particular country, but whole of world gets it.
- Solar energy helps considerable in maintenance the economical balance through the process of photosynthesis and green house effect.
- Solar energy has none the disadvantages as found in the combustion of fossil fuels such as coal, oil of gas etc.
- Solar energy is bound to achieve great economic importance in future because of depletion trend of conventional energy sources.
- Infect, solar energy is the primary source of all energy. It continues to be the renewable form of energy.
- The solar energy can be harnessed through thermal and photovoltaic routes. The thermal routes produces heat, which can be utilised un number of ways. Whereas, photovoltaic's is direct conversion of sunlight into electricity.
- Solar energy can be converted directly into heat, chemical and electrochemical energy, biomass, electricity, etc.

Disadvantages:

- Low efficiency (5-15 %) very high initial costs.

- Lack of adequate storage materials (batteries).
- High cost to the consumer.

OBJECTIVE QUESTIONS

1. The first attempt for coupling solar energy to the building was made by ……. in 1982.

[Abel Pifre]

2. The photovoltaic effect was first observed by French physicist ……. in 1839.

[Edmund Becquerel]

3. Bell laboratories used solar photovoltaic technology to produce the ……. in 1954.

[First modern cell]

4. Edmund Becquerel discovers the photovoltaic effect in…….

[1839]

5. Most of the energy we use originally came from…….

[The sun]

6. The sun generates energy from…….

[Nuclear fusion]

7. Ultimate source of fossil fuels is …….

[Sun]

8. Most of renewable energy sources can be traced back to……. energy.

[Solar]

9. The energy is obtained from the sun is …… energy.

[Solar]

10. Solar energy is the……. source of energy.

[Inexhaustible]

11. Solar energy is a time …… and intermittent …… energy resources.

[Dependent]

12. The earth gets more than enough …….solar energy to meet all of our energy needs.

[1000 times]

13. An obvious example of renewable energy is ……., where repetitive refers to the 24 hour major projects.

[Solar energy]

14. Photosynthesis is method of …… energy conversion.

[Solar]

15. Solar energy also may be stored by battery for a ……

[Long period]

16. …… may be stored in a variety of forms Heat, chemical, electrical and mechanical &magnetic.

[Solar energy]

17. Sun light produces the heat on falling object due to presence of ……. rays in the sunlight.

[Infra-red]

18. Intensity of the sunrays is higher near the …….

[Equator]

19. In sunlight, the heating rays are …… rays.

[Infra-red]

20. In sun light, the ray of longest wave length is ……. rays.

[Invisible]

21. The conversion of solar energy into chemically stored energy through biological processes known as…….

[Bio conversion]

22. The conversion of solar energy by various forms of plant and algae into organic material (fixed energy) is known as…….

[Photosynthesis]

23. A device is used for collecting solar radiation is called ……

[Solar collector]

24. Devices based on the ……. energy for examples are cooker, heater, power plants and furnace.

[Solar]

25. The devices have less efficiency ……. heating devices.

[Solar]

26. Efficiency of the ……. heating devices is very low, because they get solar energy in concentrated form.

[Solar]

27. The use of reflectors in solar heating devices is to increase ……

[Efficiency]

28. Solar energy can be stored by heating, melting or vaporization of material and the energy becomes available as heat, when the process is ……

[Reversed]

29. Percent of Infra-red rays in the sun light is about…….

[30%]

30. The first practical solar cells were made in the year …….

[1954]

31. Solar cells are usually made of ……

[Silicon]

32. The solar cells used in solar panel are used to convert solar energy into …… energy.

[Electrical]

33. Solar cells has the potential for higher conversion efficiencies than silicon …… arsenide cells.

[Gallium]

34. Solar photovoltaic technology is the direct conversion of sunlight into…….

[Electricity]

35. Photovoltaic solar cells are made of…….

[Silicon]

36. A group of solar cells is called as…….

[Solar cell panel]

37. …… cells are made of silicon, germanium and semi-conductors elements.

[Solar]

38. Solar cells are ……. devices that convert sunlight into direct current (DC) electricity.

[Semiconductor]

39. Materials with intermediate conductivity values are called ……

[Semiconductor]

40. A semiconductor is a device which can convert radiation directly into electromotive force is known as…….

[Photovoltaic cell]

41. …….is a device used for detection and or measurement of radiant energy by the generation of an electric potential.

[Photovoltaic cell]

42. ……. is the energy transmitted as electromagnetic radiation.

[Radiant energy]

43. The efficiency of conversion of sunlight into electrical power for silicon solar cells is ……

[12 to 15%]

44. A solar cell with semi – conductor material converts the solar energy into electricity to the range of about…….

[10 – 15%]

45. For terrestrial applications, silicon solar cell (photo voltaic cell) have shown operating efficiencies of about ……

[12 to 15%]

46. A typical silicon PV cell produces about ……. volt DC under open circuit, no load conditions.

[0.50 to 0.6]

47. One square meter of fixed array kept facing south yields nearly …… kwh of electrical energy on a normal sunny day if the orientation of the array adjusted to face the sun's rays at any time, the output can increase by …… percent.

[0.5, 30]

48. The solar radiation per year is reaching …… Million KWh in our country.

[5000]

49. India lies between latitude …… and receives an annual average intensity of solar radiation between …… kJ/m^2/day.

[7^0 and 37^0 N, 16700 to 29260]

50. India lies between latitude 7^0 and 37^0 N and receives an annual average intensity of solar radiation between ……

[400 to 700 cal/cm^2/day]

51. Energy received per square per meter per day in India under normal clear sky conditions varies from …… kW-h.

[4 to 7.5]

52. The diameter of the sun is ……

[1.39 x 10^6 km]

53. The average temperature of surface of the sun is ……

[5762 K]

54. Effective temperature of the sun is …….

[5762 ^{0}C]

55. The temperature of the Chromosphere at the base is ……

[4500 K]

56. The sun is assumed to be a…….with a surface temperature of…….

[Black body, 5762 ^{0}C]

57. Sun takes …….minutes to transverse…….of longitude.

[674, 1^0]

58. The per centage between the earth and the sun is …… from a mean distance of 1.5x10^8.

[3%]

59. Radiation is the mode of heat transfer by which the sun transfers energy to the…….

[Earth]

60. The total solar energy arrives at earth is ……

[177 x 10^{15}]

61. The solar energy is reflected back from the total solar energy into the space ……

[52 x 10^{15} W (30%)]

62. The solar energy is converted into heat from the total solar energy is ……

[85 x 10^{15} W (47%)]

63. The solar energy is used in the evaporation of water in the universe is ……

[40 x 10^{15} W (23%)]

64. Solar energy is utilized by plants for photosynthesis is ……

[40 x 10^{12} W (0.022%)]

65. Solar energy reaching the top of earth's atmosphere consists of about …… ultraviolet radiation.

[8 per cent]

66. Solar energy reaching the top of earth's atmosphere consists of about …… visible lights.

[46 per cent]

67. Solar energy reaching the top of earth's atmosphere consists of about …… infrared radiation.

[46 per cent]

68. Energy is radiated by the sun as electromagnetic waves of which …… have wavelengths in the range of …… micrometer.

[99 per cent, 0.2 to 0.4]

69. Ultraviolet radiation has short wavelength, less than …… micrometer.

[0.39]

70. Wavelength of visible light ranges from …… to …… micrometer.

[0.39 to 0.78]

71. Infrared radiations have long wavelength more than ……micrometer.

[0.78]

72. The rate at which solar energy arrives at the top of the atmosphere is called ……

[Solar constant]

73. The value of solar constant is approximately ……

[1353 W/m^2]

74. …….is not a true constant as it varies.

[Solar constant]

75. Appearant solar time is also called as…….

[Solar time]

76. The Local Civil Time may deviate from the true solar time is ……

[4.5^0]

77. Time as measured by the apparent diurnal motion of the sun is called ……. solar time.

[Appearant]

78. Solar energy reaching per square meter of the earth's atmosphere called solar constants is equal to ……

[1.36 kW]

79. The solar radiation receives by every square meter area of the earth's surface is ……

[1.36 kJ/sec]

80. Local civil time is reckoned from the ……. of the place of any particular meridian.

[Longitude]

81. Indian standard time corresponds to ……. longitude.

[82.5^0 E]

82. The ……. of the day is a function of Latitude and Solar declination.

[Length]

83. The difference between local solar time and local civil time is called the …….

[Equation of time]

84. Three basic ……. sun angles are Latitude, Hour angle & Suns declination.

[Earth]

85. Three additional derived ……. angles useful in solar radiation analysis are Altitude angle, Zenith angle & Solar azimuth angle.

[Solar]

86. …… is the solar angle in degrees along the horizon east or west of north or it is horizontal angle measured from north to the horizontal projection of the sun's rays.

[Solar Azimuth angle]

87. The point of the celestial sphere directly over the observer's head is called ……

[Zenith]

88. …… is a point on the celestial sphere directly over the observer's head.

[Zenith]

89. At the time of sunrise the zenith angle is …….

[$Z = 90^0$]

90. At the time of sunset the zenith angle is…….

[$Z = 90^0$]

91. …… is all the solar radiation incident on a surface including scattered reflected and direct.

[Global radiation]

92. Total insolation is a term sometimes used instead of …….

[Global radiation]

93. Solar radiation, which reaches on the ground directly from the sun, is called …… radiation.

[Direct]

94. Direct radiation or insolation is also known as ……. radiation.

[Beam]

95. A pyrheliometer is an instrument which measure……. radiation.

[Beam]

96. Diffuse radiation or insolation or sky radiation is also known as……. radiation.

[Indirect]

97. A ……. is an instrument which measures either global or a diffuse radiation over a hemispherical field of view.

[Pyranometer]

98. …… is an instrument for the measurement of the solar radiation received from whole hemisphere.

[Pyranometer]

99. Solar radiation flux is usually measured with the help of a …….or a …….

[Pyranometer or pyrheliometer]

100. Solar energy on the earth is measured with ……

[Pyranometer]

101. Pyranometer is also known as …….

[Solarimeter]

102. Solar radiation received from the sun after its direction has been changed by reflection and scattering by the atmosphere is called …… radiation.

[Diffuse]

103. The pyranometer can be also used for the measurement of……. radiation.

[Diffuse]

104. A pyranometer is used to measure the total …….radiation from both the sun and the sky.

[Short wave]

105. A pyranometer is used to measure …….solar radiation.

[Incident]

106. The duration of sunshine is recorded by ……

[Sunshine recorder]

107. …… energy storage is used for both domestic water and space heating.

[Thermal]

108. A ……. pond serves the function of Collection of solar radiation & Storage of solar radiation

[Solar]

109. Focussing collector is a device which can convert radiation directly into electromotive force is known as…….

[Flat plate]

110. When no optical concentration is done the device in which the solar radiation collection is achieved is called a……. collector.

[Flat plate]

111. In …… solar collector the liquid heated is mixture of water and glycol if ambient temperatures below 0 ^{0}C to are likely to be encountered.

[Flat plate]

112. The most favourable orientation, of a flat plate air collector, for heating only, is facing due South at an inclination angle to the horizontal equal to the latitude ……

[Plus 15^0]

113. Flat plate collector can be used for a variety of applications in which the temperatures ranging…….to about ……. are required.

[40 to 100^0 C]

114. Flat plate collector is generally used for ……

[Room heating]

115. Performance tests of liquid flat plate collector are carried out under ……. conditions.

[Clear sky]

116. The advantage of the …… system over flat plate type collectors are Reflecting surfaces require less material & are structurally simpler and the working fluid can attain higher temperatures.

[Concentrator]

117. ……heater is applicable in heating buildings, drying of agricultural products and air conditioning of buildings.

[Solar air]

118. In solar heater, the sun lights falling on the surface of spherical reflector, gets concentrated at its ……

[Focus]

119. In solar furnace, temperature can be raised up to ……

[3000 ^{0}C]

120. A type of …… reflectors used in solar furnace Concave and spherical.

[Solar]

121. In solar furnace, the sunlight is reflected by ……

[Concave reflector]

122. Temperature higher than ……. is achieved using focusing or concentrating collectors.

[100^0 C]

123. Fluid temperatures upto around…….can be achieved in cylindrical parabolic focusing collector systems.

[300^0 C]

124. In solar power plants, the turbine is run by…….

[Water]

125. A reflector used in solar power plant to reflect sunlight is ……

[Concave reflector]

126. In…….and …….systems, there is a seasonal matching between the energy needs of the refrigeration and the availability of solar radiation.

[Space cooling & Refrigeration]

127. A surface is called a ……. if the intensity of the reflected radiation is constant, for all angles reflection and is independent of the direction of the incident radiation.

[Diffuse reflector]

128. A surface is called …….if the incident and reflected rays lie symmetrically with respect to the normal to the surface at the point of incidence and the reflected beam is contained in a solid angle to the angle of the incident beam.

[Specular reflector]

129. A diffuse surface which reflects all incident energy (i.e. = 1) is termed a ……. surface.

[White]

130. Surface which absorbs all incident energy, such a surface is called a ……. surface.

[Black]

131. The sky is considered to be a…….at some equivalent sky temperature.

[Black body]

132. The fraction of the incident radiation absorbed is called the…….

[Absorptivity]

133. The fraction of the incident radiation reflected is called the…….

[Reflectivity]

134. The fraction of the incident radiation transmitted is called the…….

[Transmitivity]

135. The principle difference between the flat plate liquid collector and solar air heats is the …….of the passages for the heat transfer fluid.

[Design]

136. …….is the most commonly used medium in a sensible heat storage system.

[Water]

137. In sensible heat storage system water being used for temperature below …….

[100 ^{0}C]

138. In sensible heat storage system refractory bricks being used for temperature around…….

[1000 ^{0}C]

139. Sensible heat storage systems are simpler in design than …….or……. storage systems.

[Latent heat or thermo chemical]

140. Sensible heat storage systems cannot store or deliver energy at a ……. temperature.

[Constant]

141. Heat transfers oils are used in sensible heat storage systems for intermediate temperature ranging from …….to …….

[100 to 300 ^{0}C]

142. Hitec a molten inorganic salt can be used up to a temperature of …….in sensible heat storage systems.

[425 ^{0}C]

143. Molten inorganic salts can be used for …….temperature up to a temperatures (300 ^{0}C and above) in sensible heat storage system.

[High]

144. Sensible heat energy can be stored in …….or…….packed in insulated vessels.

[Rocks, pebbles]

145. Refractory materials are also suitable for ……. temperature sensible heat storage.

[High]

146. In a…….storage system, heat is stored in a material when it melts and extracted from the material when it freezes.

[Lower]

147. Substances having …….meeting points serve the purpose of storing latent heat energy above ambient temperatures.

[Higher]

148. An advantage associated with a latent heat storage system is that it is more compact than a ……. heat storage system.

[Sensible]

149. Thermal energy storage by causing a material to rise in temperature is called …….storage.

[Sensible heat]

150. Energy storage by causing phase-exchange, the transition from solid to liquid or from liquid to vapour is another mode of thermal storage, known as ……. in which no temperature change is involved.

[Latent heat]

151. The ability to store heat depends upon the product …….

[ρ.Cp]

152. The temperature of blackened metal sheet kept in a closed box can be raised on a clear sunny day to ……

[120 to 140 ^{0}C]

153. A burning impression on the paper is recorded in Sun Shine recorder whenever the solar radiation intensity increases ……

[200 W/m^2]

154. The value of Stefan – Boltzman constant is ……

[σ = 5.67 x 10^{-8} W/m^{2}k^4]

155. Ozone absorbs mainly in the ultraviolet band. It absorbs almost completely the short wave radiation ……

[Below 0.29 μm]

156. Thermal insulation of 5 to 10 cm thickness is usually placed behind the ……to prevent the heat losses from rear and the material are generally

Mineral wool, glass wool and heat resistance fibre glass.

[Absorber plate]

157. …… losses occurs from the absorber plate to the environment through intermediate convection exchanges between the air enclosed in each insulating zone and the boundaries of each zone the collector covers.

[Convective losses]

158. The concentration ratio achievable by non-tracking concentrators is generally …… that for tracking concentrators.

[Less than]

159. …… consists of parabolic shape reflector made up of small segments.

[Fresnel]

160. The steerable concentrators paraboloids have the …… in term of the utilization of the reflector area because in a fully steerable paraboloid there are no losses due to aperture projection effects and radiation losses are small because of the small area of the absorber at the focus.

[Highest efficiency]

161. In steerable concentrators paraboloids system, a practical size for aperture area would be about 50 m^2 from which …… of useful energy could be extracted by thermal conversion processes.

[15 to 20 kW]

162. …… surface with a total reflectivity around 95 per cent are the best reflective surfaces for solar energy applications.

[Silver]

163. The principal methods for lowering air temperature for …… are refrigeration, dehumidification and evaporation cooling.

[Space cooling]

164. In designing of the …… system, the points are generally considered are Cooling requirements, design of collector for a solar cooling building, energy storage and type of cooling system.

[Solar cooling]

165. Transmissivity like reflectivity and absorptivity is a function of the wave length and …… of the incoming solar radiation.

[Angle of incidence]

166. The moisture is removed from the air is called ……

[Dehumidification]

167. In …… cooling system, (dehumidication), moisture is removed from the air by absorbent such as Silica –gel or lithium chloride, ethylene glycol and lithium chloride or lithium bromide.

[Open cycle]

168. The system involves space heating with solar energy in winter and cooling by and radiation to night sky and evaporation of water in summer accomplished with ceiling ponds and movable insulation ……

[Sky therm system]

169. In recent years, …… power generation has been receiving considerable attention as one of the more promising energy alteration. The reason for this rising interest Conversion of sunlight to electricity, non polluting nature and PVS non-dependence of fossil and nuclear fuels.

[photo-voltaic]

170. The ……level are The energy at which the probability of a state being filled by an electron is exactly one-half and the highest energy state an electron can have 0 K.

[Fermi energy]

171. Water, Iron shot, concrete, rock and gravel materials are generally used …… heat storage.

[Sensible]

172. Water has the characteristics for …… storage medium are it is an inexpensive, readily available and it has high thermal storage capacity.

[Solar energy]

173. …… and phase change energy storage in this system, heat is stored in a material when it melts and extracted from the material when it freezes.

[Latent heat storage]

SOLAR DISTILLATION

174. Solar energy can be used for converting saline water into distilled water. The equipment used for this process is called …….

[Solar still]

175. Energy required for distillating 1 litre of brackish water …….

[2260 kJ]

176. Solar water distillation water is evaporated because of …….difference.

[Partial pressure]

177. Aqua – ammonia solar refrigeration system required generator temperature is ……^{o}C to ……^{o}C which cold be possible with concentrating type

collector.

[120 to 150]

178. Operating efficiencies of …… % for basin type solar still have been achieved in practical units.

[35 to 50%]

SOLAR COOKER

179. A device, which is used to heat the food by utilizing the energy radiated by the sun, is called as…….

[Solar cooker]

180. Devices based on the ……. are cooker, heater, power plants and furnace.

[Solar energy]

181. The……. wave length solar radiation is not able to pass through the glass sheet.

[Higher]

182. In solar cooker, the sun light is reflected by …….

[A plane mirror]

183. In flat plate box type solar cooker the amount of solar radiation intensity can be increased by providing…….

[Mirror or mirrors]

184. The material used inside the inner side of solar cooker should be made of ……

[GI sheet or Aluminium sheet]

185. Insulated metal / wooden box of solar cooker is painted …….

[Black from inside]

186. In solar cooker, the inside temperature rises from…….

[100 to 140 ^{0}C]

187. On sunny day's temperatures around…….can be obtained in box type solar cooker.

[100^0 C]

188. Maximum air temperature obtained inside the solar cooker box (without load) is …… ^{o}C in winter and ……^{o}C in summer.

[140 and 160]

189. Maximum air temperature obtained inside the flat plate box type solar cooker

(without load) is …….in winter.

[140 ^{0}C]

190. Maximum air temperature obtained inside the flat plate box type solar cooker (without load) is …….in summer.

[160 ^{0}C]

191. Liquid flat plate collectors are generally used for obtaining hot water at temperature less than…….

[100 ^{0}C]

192. In dish type solar cooker, temperature achieved at the bottom of the vessel is around …….

[300 to 400 ^{0}C]

193. A…….to…….rise in temperature is achieved inside the box type solar cooker, when reflector is adjusted to reflected the sun rays into the box.

[15 to 25 ^{0}C]

194. With flat plate box type solar cooker maximum no load temperature with a single reflector reaches up to…….

[160 ^{0}C]

195. With multi reflector type solar oven temperature obtained is of the order of…….

[200 ^{0}C]

196. With parabolic disc concentrator type solar cooker, temperatures of the order of ……. can be obtained.

[450 ^{0}C]

197. Dish type solar cooker is having a thermal efficiency of around…….

[40%]

198. The best time of the day for cooking in box type solar cooker is between ……

[11.00 AM to 2.00 PM]

199. Rice, vegetables, dals and meat … can be cooked in ……solar cookers.

[Box type]

200. …… cannot be cooked in box type solar cookers.

[Chapaties]

201. …… reflector type cookers were developed by National Physical Laboratory of India and cookers are Simple in design, low cost and but house wife has to cook the food out of doors in the sun.

[Circular parabolic]

202. In which direction solar cooker should be oriented to have the maximum efficiency……

[South]

SOLAR WATER HEATER

203. A device, which is used to heat the water by utilizing the energy radiated by the sun, is called as……. heater.

[Solar water]

204. In solar heater, the sun light is reflected on to black pipes containing water, by means…….

[Plane reflector]

205. The capacity of solar water heater heating system can be boosted by ……. collector area.

[Increasing]

206. Orientation of solar appliances ……. facing.

[South]

207. Insulation is provided to minimize ……. losses.

[Heat]

208. A 100 litre solar water heater can saves about…….of electricity annually.

[2000 units]

209. The required collector area for 50 litre hot water demand at 50 ^{0}C is about …….

[1 m^2]

210. When heat transfer is within the substance from high temperature regions to low temperature regions is called as ……

[Conduction]

211. Solar water heater which is direct natural circulation type is …… type solar water heater.

[Thermo – siphon]

212. Liquid flat plate collector are generally used for obtaining hot water at temperature less than ……

[100 ^{0}C]

213. The use of the …… cover in solar heating devices is for preventing the heat loss absorbed heat.

[Glass sheet]

SOLAR DRYER

214. In cabinet type solar dryer temperatures ranging from……. to…….are usually attained.

[50 to 80 ^{0}C]

215. Products like dates, apricots, chillies, grapes, etc. are dried in…….dryer.

[Solar cabinet]

216. In cabinet type solar dryer the drying time ranges from……. days.

[2 to 4]

217. In solar…….dryer, the solar radiation does not fall on the product to be dried.

[Convective]

218. Energy farms are ideal …… collectors requiring virtually no maintenance, economical and non-polluting.

[Solar]

Part 3: Wind Energy

World Wind Energy Scenario:

Wind energy is used for applications like grid-connected, electricity, water pumping and power supply in remote areas.

The technical potential of onshore wind energy is again very large 20,000 to 50,000 TWh per year against the current total annual world electricity consumption of about 15,000 TWh.

The economic potential depends upon factors like average wind speed, stastical wind speed distribution, turbulence intensities and the costs of wind turbine systems. Because the energy of the wind is proportional to the third power of the wind speed, the economic calculations are very sensitive to the local average annual wind speed.

Because wind energy is intermittent, wind turbines mainly deliver energy but very little capacity. Typical capacity values being often less than 20 % of the installed wind power.

Wind energy in India:

In India wind energy programme was started by establishment of 4 number of 0.55 MW demonstration projects. MNES has so far installed 220 No. of mast spread over the 15 states in the country. Out of 220 stations installed, nearly 95 stations qualify the limit of 18 kmph wind speed, 46 are above 20 kmph and only 7 stations are above 23 kmph wind speed. Even though a rough assessment indicates the possibility of 20,000 MW power generations in India. Till Dec. 2000, the total installed capacity from wind energy in India has grown to 1267 MW.

Application of wind energy:

- Water pumping.
- Power generation, i.e. electricity generation for home use.
- Farm and Ranch: wind energy electrical generators are used for farm system as electrical fences and yard light and other farm application.
- Wind energy for battery charger and other application.

Advantages:

- Wind energy is environment friendly & pollution free.
- Wind power generation is cheaper because there is no input cost & recurring expenses are almost nil.

- Supplemental power in windy areas.
- Best alternative for homeowner.

Disadvantages:

- Highly variable source.
- Relatively low efficiency (30%).
- More power than is needed is produced when the wind blows.
- Efficient energy storage is thus required.

OBJECTIVE QUESTIONS

1. Air in motion is called as …….

[Wind]

2. Wind is the……. source of energy.

[Inexhaustible]

3. Wind energy is a form of …… energy.

[Solar]

4. The wind energy is derived from ……. energy.

[Moon's]

5. Wind due to its motion possesses the …… energy.

[Potential]

6 Wind energy available is …… and fluctuating in nature.

[Dilute]

7. Unlike water energy wind energy needs …… because of its regularity.

[Storage capacity]

8. Wind is the result of uneven heating of the ……

[Earth planet]

9. The suitable type of wind mill for lifting water by using reciprocating pump……. type.

[Multi blade]

10. In wind mill, the ratio of power delivered by rotor to the maximum power available in the wind mill is called ……. of performance.

[Coefficient]

11. Maximum power available in the wind, is given by…….

[$\frac{1}{2} \rho A V^3$]

12. The power in the wind is proportional to the …… of its velocity.

[Cube]

13. The ratio of the speed at the tip of rotor to the wind speed is called ……

[Tip speed ratio]

14. Tip speed ratio of wind mill is the ratio of wind speed at the rotor tip to the …….

[Wind speed]

15. Wind energy is used to …….

[Propel sail – boats]

16. A wind energy map gives the information about annual average ……. of wind.

[Speed]

17. A wind energy map provides information about ……. energy available.

[Wind]

18. It has been estimated that roughly …… megawatts of energy are continuously available in the earth's wind.

[10 million]

19. The gross wind power potential of India is estimated at about ……

[45,000 MW]

20. The average capital cost of a wind farm project works out to …….per MW.

[3.5 to 4 crore]

21. Wind map of India shows that the most of area (about 70 to 80%) of the country comes under …… kmph wind speed (average of 30 years) and it is also observed that wind speed is generally at its peak during month of ……
[5-10, June-July]

22. High wind – energy region of the India is …….

[Gujarat]

23. ……. speed regions of the India are Gujarat, parts of Rajasthan & Bay of Bengal.

[High wind]

24. In a wind mill, if wind velocity increases two times, power from the wind mill increases …… times.

[8]

25. In normal conditions, a wind mill generates …… hp of power.

[0.5]

26. Theoretically available conversion of a wind mill is …… however, in practice we get ……

[60%, 30%]

27. The wind velocity of over …… kmph is necessary for satisfactory operation of wind mill.

[12 to 16]

28. An aero – generator satisfactory operates at …… kmph speed.

[24 to 36]

29. 3.5 m diameter wind mill develop approximately …… hp.

[0.5]

30. For India wind speed value lies between …… km/h to …… km/h.

[5 to 10]

31. Wind speed 5 – 6 km per hour is suitable to run ……

[Wind pump]

32. The sail wing type wind mill not works at a wind speed less than ……

[8 kmph]

33. For working a windmill, the minimum speed of wind should be ……

[5 km/h]

34. In practice, windmill type devices or anemometers measure ……

[Wind power]

35. The wind power is related to the wind speed by the empirical formula ……

[$P = 0.37 (V/10)^3$]

36. Convertible wind power or energy is proportional to the …… of the wind speed.

[Cube]

37. Vertical axis machines are of …… design as compared to the horizontal axis.

[Simple]

38. The Savonius rotor works like a ……

[Cup anemometer]

39. The Savonius rotor requires relatively …… winds for operation.

[Low velocity]

40. The Savonius rotor do not requires relatively much about the ……

[Wind direction]

41. The Savonius performs even at …… wind velocity ranges.

[Lower]

42. The Savonius rotor is useful for a …… installations.

[Very tall]

43. The Savonius rotor is used along with Darrieus rotor for …… purposes.

[Strong]

44. Darrieus machine is a type of …… machine.

[Vertical]

45. The horizontal axis multiblade type wind mill have …… power coefficient and …… starting torque.

[Good, high]

46. In …… wind machine, rotor weight is less.

[Horizontal axis]

47. …… type wind mill is one of the oldest designs.

[Dutch]

48. …… surface of sail type windmill is made from cloth, nylon or plastic arranged as mast and poles and sails wings.

[Blade]

49. Blades of sail unit are made of ……

[Canvas cloth]

50. Wind increases with height and they have traditionally been measured at a standard height of 10 m where they are found to be …… greater than close to the surface.

[20 to 25%]

51. Factors determine the ……from a wind energy converter are Wind speed, cross section of wind swept by rotor, overall conversion efficiency of the rotor, transmission system and generator or pump.

[Output]

52. Available wind power is proportional to the ……of wind speed, air density and intercept area.

[Cube]

53. The best sites, for wind energy are found off shore and sea coast. An average value on the coast is …… per year.

[2400 kWh/m^2]

54. Savonius and Darrius are the type of …… axis wind mills.

[Vertical]

55. Dutch and Sail are the type of …… axis wind mills.

[Horizontal]

56. Wind energy is one of …… greatest natural resource.

[America's]

57. Conversion of kinetic energy into …… energy that can be utilized to perform useful work or to generate electricity.

[Mechanical]

58. Wind speed increases with …… because of reduction in drag effect of the earth's surface.

[Height]

59. A 100% efficient aero generator would be only able to convert up to a maximum of around …… of the available energy of wind into mechanical energy.

[60%]

60. The …… works on the principle of converting Kinetic energy of the wind into mechanical energy.

[Wind mill]

61. A sail boat utilizes the energy of ……

[Wind]

62. A windmill suitable for water lifting is …… type.

[Multiple blade]

63. The ratio of the speed at the tip of rotor to the wind speed is called …… ratio.

[Tip speed]

64. In multi-blade rotor, the number of blades varies from ……

[8-12]

65. The speed of multi-blade rotor is …… rpm.

[60-80]

66. A sail type unit has ……

[3 blades]

67. Propeller type unit runs at a speed of …… rpm.

[300 – 400]

68. Pump used in the may be Reciprocating, diaphragm and rotor.

[Wind mill]

69. In a windmill, tip speed ratio increases with …… number of blades.

[Decrease]

70. An anemometer is used to measure ……

[Air velocity]

71. The average capital cost of a wind farm project works out to Potential energy which through downward moment of water converted into ……

[Kinetic energy]

72. The efficiency of hydro electric power plant depends of effectiveness of ……

[Wind turbine]

73. ……are contours of contours of contours of constant wind power (watts/m^2 of area perpendicular to the wind flow).

[Isodynes]

74. In charged battery, electrical energy is stored as …… energy.

[Chemical]

75. Possible storing ……energy is in a volume of compressed air, in water power storage or mechanical storage and stored as hot water (heat storage).

[Wind]

76. In propeller type wind turbine, force acting in the direction of wheel rotation that provides the torque is called …… force.

[Circumferential]

77. Energy extracted from the …… is initially energy in the form of Rotary, translational and Oscillatory.

[Wind]

78. …… can be used in centralized utility application to drive synchronous a.c. electrical generators, to drive heat pumps and to pump irrigation water.

[Wind power]

Part 4: Biomass

World Biomass Scenario:

The world derives a little over 10 % of its energy from Biomass. In the developing and the poorest countries, Biomass is the most important energy source. In the two largest developing countries, China and India, Biomass accounts for almost 20 % and 40% respectively of the primary energy supply. In some of the world's poorest countries, biomass accounts for up to 90 % of the energy supply mostly in traditional/ non-commercial forms.

The resource potential of Biomass energy is much larger than the current world energy consumption. But given the low conversion efficiency of solar to biomass energy (<1 %), large areas are needed to produce modern energy carriers in substantial amounts. The availability of land for energy plantations critically depends on the food supplies needed and on the possibilities for intensifying agricultural production in a sustainable way.

Biomass in India:

The availability of biomass/ agril waste is in huge quantity widely spread all over the country. It is estimated that nearly 17000 MW power can be generated through biomass available in the country. Govt. promoted the biomass based power generation system for decentralized power generation in rural sector. Uptill now 273 MW power is produced from biomass based power projects.

Application:

- Direct combustion & cogeneration.
- Production of biofuels such as ethanol and biodiesel.
- Production of biogas through anaerobic digestion of biomass.
- Densification: briquetting & pelletizing technology.
- Gasification technology to produce producer gas.
- Charcoal production.

Advantages:

- Biomass is widely available.
- The technology of production of biomass and conversion is simple and easy to understand.
- Biomass energy suitable for small or large scale application.
- Its production requires only low light intensity.

- It need only low temperature (5-35 ^{o}C).
- Biomass energy incorporates storage facility and hence transportation is easier.
- Biomass energy doesn't yield net or absolute pollution, if properly combusted.
- The profound transformations of the energy market worldwide, driven by privatization, deregulation, decentralization and concern with the environment
- Greater recognition of its current role and future potential contribution as a modern energy carrier
- Increasing concern about rising oil prices and vulnerability of supply
- Availability, versatility, and sustainability of bio energy
- Better understanding of its global and local environmental benefits
- Perceived potential role in climate stabilization
- Existing and potential development and entrepreneurial opportunities
- Technological advances and knowledge which have evolved recently on many aspects of biomass energy
- Growing interest in renewable energy in general, driven mostly by energy security and concern with potential implications of global warning.

Disadvantages:

- Particulate pollution from biomass burners.
- Transport not possible due to moisture content; unclear if growing biomass just for burning use is energy efficient.
- Large scale facilities are likely impractical.

OBJECTIVE QUESTIONS

1. The material of the plant and animal is called …….

[Biomass]

2. ……. is produced through chemical storage of solar energy in plants and other organic matter as a result of photosynthesis.

[Biomass]

3. The chemical composition of biomass varies among species & its nature, but a plant consists of about …… lignin and …… carbohydrates or sugars.

[25% and 75%]

4. …… of biomass depends on moisture content, shape & size of the biomass.

[Bulk density]

5. Biomass is produced through chemical storage of …… energy in plants and other organic matters as a result of photosynthesis.

[Solar]

6. …… are not economical to transport them over long distances and conversion into usable energy must take place close to the source because Biomass are highly dispersed and bulky, contain large amount of water.

[Biomass]

7. The …… plants are considered promising for biomass production are water hyacinth, Algae and Ocean kelp.

[Marine]

8. The potential of biomass power in country has been estimated at about ……

[19,500 MW]

9. It is estimated that …… of land having energy plantation can support power generation of ……

[1000 ha, 3 MW]

10. The process is to increase bulk density of biomass for efficient and convenient, transportation and handling called as …….

[Densification]

11. Average daily consumption of fuel is about …….of dry biomass per person.

[0.5 to 1 kg]

12. Pyrolysis of biomass produces ……

[Charcoal]

13. Pyrolysis is the basic …… chemical process for converting solid biomass to a more useful liquid fuel.

[Thermo]

14. Charcoal production is form of pyrolysis with …… available oxygen.

[Limited]

15. Change in smoke colour from while to blue shows the progress in …….

[Carbonization]

16. Charcoal processes are generally called ……. when they are mainly at making charcoal.

[Carbonization]

17. Charcoal is produced as a result of the chemical reduction of organic materials under …….conditions.

[Controlled]

18. The first stage of carbonization is …….

[Endothermic]

19. Second stage of the carbonization processes in the …….stage.

[Pre-carbonization]

20. The second stage in the carbonization process is also known as…….

[Endothermic]

21. Precarbonization stage occurs in the……. temperature range.

[150 °C]

22. Soft burned & hard burned are the two types of ……

[Charcoal]

23. Charcoal yield from pits is extremely …….

[Low]

24. Capital investment for pit type kiln is …….

[Minimal]

25. In metal kiln airflow can be controlled during ……. process.

[Carbonization]

26. Better charcoal quality is obtained in the metal kiln than …….kilns.

[Earth]

27. Metal kiln is a …….kiln.

[Portable]

28. In TPI kiln production of charcoal per cycle is …….kg.

[300 to 400]

29. Brick kiln yields high quality charcoal suitable for both …….and …….use.

[Industrial & domestic]

30. The Argentinean kiln has fewer vents but no…….

[Chimney]

31. Brick kiln are cheaper than …….kilns.

[Metal]

32. Brick kiln has a life span of …….years.

[5 to 8]

33. Brick kiln has a ……. production cycle.

[Long]

34. Cement kilns are also known as ……. kilns.

[Missouri]

35. A soft burnt charcoal is carbonized at ……. temperature.

[Lower]

36. A soft burnt charcoal has a high ……. content and low…….content.

[Volatile matter & fixed carbon]

37. Hard burnt charcoal is more …….

[Friable]

38. Hard burnt charcoal is deficient to …….

[Ignite]

39. Hard burnt charcoal high in ……. content and low in …….content.

[Fixed carbon, Volatile matter]

40. Quality of ……. depends on its chemical & physical properties.

[Charcoal]

41. Two types of earth kilns are ……. kilns and ……. kilns.

[Mound and Pit]

42. ……. kilns are the traditional form of charcoal manufacture.

[Mound]

43. Mound kiln has a volume of ……. m^3.

[30 to 100]

44. Mound kilns are constructed in area of ……. soils.

[Rocky]

45. Charcoal yields from, Cement kilns can be high as …….

[25 to 33%]

46. Retort kilns are known as …….

[Ovens]

47. Retorts are more …….

[Expensive]

48. Retort produces ……. acids.

[Pyroligenous]

49. Ethanol produced from sugars under acidic condition with pH…….

[4 to 5]

50. Sugar is obtained from molasses having …….

[55% sugar]

51. The thermal efficiency of an improved cook stove is in the range of ……

[15 to 20%]

52. The thermal efficiency of a traditional chullah is ……

[10%]

53. …… is one of the most widely used harvesting methods in which the tree is cut at the base, usually between 15-75 cm above the ground level.

[Coppicing]

54. …… is harvesting system, in which the branches including the top of the tree are cut, at a height of about 2 meter above the ground and the main trunk is allowed standing.

[Pollarding]

55. …… , in this method most of the branches of the tree are cut.

[Lopping]

56. …… is very common harvesting method. It involves the cutting of smaller branches and stems.

[Prunning]

Part 5: Biogas

1. As far as history of biogas is concerned, it is known from time immemorial that a gas which can burn is emitted from the marshy lands. The gas is called methane. It was discovered by …….

[Shirley in 1667]

2. Scientific study of methane production was carried out by …….

[Alessander Volta in 1776]

3. Hamper Davey noted the presence of methane in farmyard manure in …….

[1800]

4. In India, biogas has about 100 years of history. First model Gramlaxmi was developed by ……. of KVIC (Khadi & Village Industries Commission.

[Shri Joshbai J. Patel]

5. ……. is obtained by the anaerobic fermentation of animal waste & plant waste.

[Biogas]

6. Biogas is obtained by the anaerobic fermentation of animal waste is carried out in absence of …….

[Water]

7. During biogas formation, the fermentation of animal waste is carried out in absence of …….

[Oxygen]

8. Conversion of biomass in absence of …….

[Oxygen]

9. In India, the mainly used material to form the biogas is …….

[Cattle dung & gobar]

10. ……. is a gaseous form of methane, carbon dioxide, hydrogen sulphide and several other gases.

[Biogas]

11. Gobar gas plant is a ……

[Biogas plant]

12. Gobar gas contains which gas in a larger proportion …….

[Methane]

13. Biogas contains which gas in a larger proportion…….

[Methane]

14. Bio gas obtained by the action of bacteria on domestic sewage, is called as ……. gas.

[Sewage]

15. Biogas is the mainly mixture of …… and ……

[Methane & carbon dioxide]

16. Biogas containing …….methane and …….carbon dioxide.

[55-65% & 30-40%]

17. The biogas required for cooking per person per day is…….

[0.24 cum]

18. The quantity of Gobar gas required to cook one – person meal is ……

[5 kg]

19. Heart of biogas plant is …….

[Digester]

20. Digester may be of a …… chamber or a …… chamber type.

[Single, double]

21. In biogas plants, the diameter of the digester ranges from…….

[1.2 – 6 metre]

22. In biogas plants, the depth the digester ranges from …….

[3 – 6 metre]

23. Gas production per unit volume of digester capacity is maximum when the diameter to depth ratio ranges of ……

[0.66 to 1.00]

24. Ratio of cow dung and water for making slurry to feed the biogas plant is …….

[1:1]

25. Raw cow dung contains …… of moisture.

[80 – 82%]

26. In biogas plant proportion of cattle dung mixed with water is ……

[4:5]

27. The optimum level of total solid content for cattle dung slurry is in the range of ……

[8 to 10%]

28. In biogas plant, the dung and slurry are left in the digester, initially for a period

of ……. days.

[40 - 60]

29. Normal value of the retention period is between …… days.

[30 to 45]

30. The retention time should not be less than ……, for gas production.

[24 days]

31. The best biogas production the temperature required…….

[35 to 37 ^{o}C]

32. A high gas production from biogas plant is achieved, when inside temperature of the chamber is around …….

[35 ^{o}C]

33. Methane bacteria work best at a temperature ……

[At 35 – 38 ^{0}C]

34. Gas production from bio gas plant is reduced very much, when temperature inside the chamber is …….

[Below 15 ^{0}C]

35. The biogas production start of falling very steeply when the temperature goes below …… ^{O}C and almost stops at …… ^{O}C.

[25 and 10]

36. pH value slightly higher of …… has been reported to be optimum for digestion of raw animals or plant waste.

[8.2]

37. The optimum thermophilic temperature is around ……

[55 ^{0}C]

38. The optimum mesophilic temperature lies at about ……

[35 ^{0}C]

39. The dung requirement (kg/day) for the smallest size of gobar gas plant is…….

[25]

40. When temperature is raised to 28.3 ^{0}C the gas production increased by …… to …… cu. m. per day.

[50% to 3.75]

41. Quantity of cattle dung required for size of biogas plant of 20 m^3 capacity ……

[500 kg]

42. To feed even the smallest size of biogas plant, the requirement of minimum number of cattle is…….

[6 – 8]

43. Density of the slurry is …… kg/m^3.

[1090]

44. The pH varies for better biogas production is…….

[6.5 to 8.0]

45. In biogas nitrogen is present in the range of …….

[1 – 5]

46. Gobar gas manure contains about …….per cent of nitrogen.

[2.0]

47. A carbon to nitrogen ratio of…….is found to be optimum for biogas production.

[20:1 to 30: 1]

48. The Carbon Nitrogen (C/N) ratio in batch digester biogas plant to increase the microbial activities after pre digestion is ……

[25 to 30:1]

49. Gas produced from 1 kg of gobar in winter (November to February) is generally …… litres.

[42]

50. Gas produced from 1 kg of gobar in summer (March to October) is generally …… litres.

[55]

51. From 1 kg of wet dung, a biogas plant can produce the gas ……. cubic metre.

[0.037]

52. Capacity of biogas plant varies from ……. cubic metre.

[2 – 150]

53. Capacity of smallest biogas plant is about ……. metre.

[1 cubic]

54. The smallest size of economical gobar gas plant is……..

[30 cubic feet]

55. The gobar gas required to operate one HP engine per hour is…….

[425 litre]

56. Biogas is almost…….lighter than air and has an ignition temperature of …….

[20%, 650 - 750 ^{o}C]

57. Octane rating of biogas without CO_2…….

[130]

58. One cubic meter of biogas replace as fuel diesel…….

[0.52 lit]

59. The danger of explosions of biogas is less as it contains …… which acts as a fire extinguisher.

[Carbon dioxide]

60. Water content in biogas plant slurry should be about ……. of the weight of the total content.

[90%]

61. Farm yard manure contains about …….per cent of nitrogen.

[0.75]

62. Petrol engines can be run on 100% …….

[Biogas]

63. Existing diesel engines can be modified to run on …….

[Dual fuel]

64. ……. is only used for starting dual fuel engine.

[Dual fuel]

65. Regulating the feed volume daily can control the ……

[Retention time]

66. Volume of the gas retained by the gas holder is generally considered as ……

[70%]

67. The gas is available at a pressure of about 10 cm of water column in …….

[KVIC model]

68. In floating drum type release of gas is at …….

[Constant pressure]

69. In areas having high water table…….could be installed.

[Horizontal plant]

70. Ferro cement digester is an example of …….biogas plant.

[Floating drum]

71. In fixed dome type biogas plant, the gas is liberated at a variable pressure ranging from …….water column.

[0 – 90 cm]

72. Janata biogas plant was first developed by the Planning, Research and action Division, Lucknow in …….

[1978]

73. In upflow anaerobic sludge blanket reactor, the feedstock is generally required to have

a pH greater than…….

[5.5]

74. In anaerobic fluidized bed reactor…….is required for fluidization.

[Power]

75. Various fuels and material can be produced by …….

[Bio conversion]

76. …….is a chemical decomposition process through addition of water.

[Hydrolysis]

77. Methanol is a toxic liquid made from the catalytic reaction of Hydrogen & ……. at 330 ^{0}C.

[Carbon monoxide]

78. Methanogenic bacteria convert ……. and ……. to methane.

[CO_2 & hydrogen]

79. In aerated lagoon process requires ……. for retention time.

[10 days]

80. The optimum temperature of digester slurry in Mesophillic zone is …….

[35 ^{0}C]

81. ……. plant is modification and advance version of Janata fixed dome type biogas plant.

[Deenbhandhu]

82. The gas is available at a constant pressure in ……. plant .

[KVIC]

83. Vertical model of floating gasholder type biogas plant is suitable for ……. areas with ……. water tables (>3m).

[Non-rocky, lower]

84. Horizontal model of floating holder type biogas plant is recommended for rocky areas with high water tables …….

[<1.5 m]

85. ……. is only used for starting dual fuel engine.

[Petroleum liquid]

86. Pragati biogas plant is a combination of ……. design.

[KVIC and Deenbandhu]

87. The pressure inside the digester varies as the gas collected in …… type biogas plant.

[Fixed]

88. The pressure inside the digester constant as the gas collected in …… type biogas plant.

[Floating]

89. In fixed dome type biogas unit digester and gas holder form an ……. combined unit.

[Underground]

90. In fixed dome type biogas plant the dimensions of the inlet and outlet are bigger than those of the ……. type biogas plant.

[Floating gas holder]

91. In fixed – dome type biogas plant, the gas – holder is …….

[Fixed & non floating]

92. In fixed – dome type biogas plant, the gas – holder is made of …….

[Bricks & cement]

93. In fixed – dome type biogas plant, the digester tank and gas - holder is combined in …….

[One unit]

94. Fixed – dome type biogas plant is also known by the local name is……. gobar-gas plant.

[Janta]

95. In fixed dome type biogas unit the diameter and height ratio of the digester is fixed at…….

[1.75:1]

96. In fixed dome type biogas unit the volume of the gas dome is ……. of the plant capacity.

[60%]

97. In floating gas – holder type biogas plant, the type of gas holder is……. drum type.

[Inverted]

98. In floating gas – holder type biogas plant biogas plant, the gas holder floats over…….

[Dung slurry]

99. There are two types of processes for anaerobic fermentation ……

[Continuous & Batch]

100. Continuous type of process for anaerobic fermentation is suitable for …… flowing suspended materials.

[Free]

101. Batch type of process for anaerobic fermentation is applicable to …… materials.

[Light]

102. A biogas lamp needs a mantle, which is made of a …….

[Ramic fibre]

103. …… contains all the nutrients needed by organisms for the production of biogas.

[Cow dung]

104. Under optimum conditions 80 - 90% of total gas production is obtained within a period …… of weeks.

[3 – 4]

105. About …… of the original weight of cattle dung is conserved in a biogas unit.

[70 – 75%]

106. Digested slurry is a good source of ……

[Micronutrient]

107. Complete digestion of cattle dung in biogas in unit kill ……

[Weed seed]

108. Use of biogas in diesel in engines is limited to the …… engine.

[Stationary]

109. Biogas dual fuel engine requires …… of diesel and rest of the energy is obtained from biogas.

[15 – 20%]

110. The cost of installation of digester of Ganesh biogas plant is about …… less than KVIC plant.

[30 – 40%]

111. In KVIC plant …… is not designed to take any load.

[Ledge]

112. Function of ledge to …… gas forming on the sides of the plant into the gas holder.

[Deflect]

113. A gap of …… mm is normal between the gas holder and the walls.

[50]

114. Mixture is usually recommended for plant of …… and highest sizes.

[6 m^3]

115. The digester portion of Ganesh biogas plant is made of an …… frame.

[Angle iron]

116. Exhaust smoke density of the biogas dual fuel engine is …… when engine runs on biogas.

[Less]

117. Exhaust gas temperature of the biogas dual fuel remains almost the ……

[Same]

118. General cleanliness of the dual fuel engine, with biogas is better than the …… operations.

[Diesel]

119. ……can be used for cooking, lighting & running the engine.

[Biogas]

120. Biogas in a biogas digester is produced by a chemical process known as ……

[Fermentation]

121. The flow rate of Nitrogen is required is required to create the oxygen free inert atmosphere to avoid combustion of biomass is ……

[300 cc/min]

122. The cellulose and hemi cellulose are converted into soluble organics in anaerobic digestion of biogas production is through fermentative bacteria & ……

[H_2O]

123. …… retention time is the volume of days the feed material is required to remain in the digester to begin gas production.

[Hydraulic]

124. …… & …… models are fixed dome type biogas plants.

[Janata & Deenbhandu]

125. The gas is available at a constant pressure in …… type biogas plant.

[KVIC]

126. The ……digestion consists broadly of three phases. They occur in this sequence enzymatic hydrolysis, Acid formation, Methane formation.

[Anaerobic]

127. …… is partially submerged mat of floating solids that may form at the surface of the fluid in the septic tank.

[Scum]

128. Septic tank should always be …… m away from the source of water.

[30]

129. Best site for installation of a …… unit it should not be away from the kitchen, It should be near the cattle shed & It should be near the drinking water.

[Biogas]

130. Some …… plants were found to be dysfunctional and the most common reason is the change in cattle holding of families over time, biogas plants getting into a state of disrepair of components (like stove parts) getting damaged & lack of maintenance of plants by users.

[Biogas]

131. The main reasons for improper usage and mishandling of the …… are lack of awareness & working knowledge on the functioning of the plant.

[Biogas plants]

132. The benefits of the …… are in terms of time saved in fuel procurement and cooking, improved kitchen and convenience & reduction of drudgery of transporting fuel wood.

[Biogas]

133. There are two models of floating gas holder type biogas plant i.e. vertical and

horizontal. The vertical model is suitable for …… with low water tables.

[Non – rocky areas]

134. The horizontal model is suitable for …… with high water tables.

[Rocky areas]

135. The horizontal plant is suitable for ……

[Stony areas]

136. Fixed – dome type (Janata model) biogas plant was first developed by ……

[State planning Institute, Lucknow]

137. There should be provision for removal of water from the pipeline by means of providing a correct slope to the pipeline. The recommended slope is ……

[1: 100]

138. Janata biogas plant was first developed by the Planning, Research and Action Divison, Lucknow in ……

[1978]

139. The pH value for digestion of sewage solids is reported to be in the range ……

[7 to 7.5]

140. Most municipal sewage treatment plants operate at a loading rate of …… of volatile solids per m^3 per day.

[0.5 to 0.6 kg]

141. Gas production per unit volume of digester capacity is maximum when the diameter to depth ratio ranges of ……

[0.66 to 1.00]

142. The most activity digesting sludge is in the …… of digester.

[Lower half]

143. Methanogenic bacteria multiply at the ……

[Slower rate]

144. In aerobic digestion, the biogas production by bacterial decomposition is done in presence of ……

[Oxygen]

145. The pressure inside the digester varies as the gas collected in ……

[Fixed type biogas plant]

146. The pressure inside the digester constant as the gas collected in ……

[Floating type biogas plant]

147. The pH value for digestion of sewage solids is reported to be in the range ……

[7 to 7.5]

148. Most municipal sewage treatment plants operate at a loading rate of …… of volatile solids per m^3 per day.

[0.5 to 0.6 kg]

149. The most activity digesting sludge is in the …… of digester.

[Lower half]

150. Methanogenic bacteria multiply at the ……

[Slower rate]

151. In aerobic digestion, the biogas production by bacterial decomposition is done in presence of ……

[Oxygen]

152. ……. as such does not contribute to the charcoal production.

[Lignin]

Part 6: Gasifier

1. The conversion of solid biomass into a gaseous fuel through a thermal route called as …….

[Gasifier]

2. Gasifier converts solid fuel into ……. fuels.

[Gaseous]

3. The gas obtained through gasification called as …….

[Producer gas]

4. Combustible mixture of Producer gas …….

[CO and H_2]

5. Gasifier are classified according to the ……. in the fuel column.

[Air introduction]

5. Gasification process is carried out in …… stages.

[Four]

6. The actual combustion of char, pyrolysed gases and tars takes place …… zone.

[Oxidation]

7. The moisture content below …… by weight is desirable for trouble free and economical operation of the gasifier.

[15%]

8. Air ratio required for gasification …….

[2.38 kg wood/kg air]

9. Principal production in reduction zone …….

[CO]

10. Calorific value of Producer gas (wet basis) …….

[5506 kJ/Nm^3]

11. Air enters below the combustion zone and the producer gas leaves near the top of the gasifier is called ……

[Up draft gasifier]

12. In ……. gasifier the reactions gases flow counter to the path of the incoming cool feed stock and exit at a relatively low temperature.

[Updraft]

13. Air enters below the combustion zone and the producer gas leaves near the

top of the gasifier is called …… gasifier.

[Up draft]

14. In an updraft gasifier the air is introduced at the …… and the feedstock is led at top side.

[Bottom side]

15. In an updraft gasifier the air is introduced at the bottom side and the feedstock is led at ……

[Top side]

16. In up draught gasifier air enters at the ……. and the producer gas leaves near the ……. of the gasifier.

[Combustion zone & top]

17. In updraft gasifier the height to diameter ratio is usually kept…….

[3:1]

18. Air enters top the combustion zone and the producer gas leaves near the bottom of the gasifier is called …… gasifier.

[Down draft]

19. In down-draught gasifier air enters at the ……. and the gas produced near the ……. of the gasifier.

[Combustion zone & bottom]

20. The ……. gasifier is found the most suitable for engine application.

[Downdraft]

21. Entrained flow gasification of biomass will generally require ……. for the solids.

[Pressurizing equipment]

22. Free moisture in the fuel influences …….and ……. at all stages.

[Performance & Costs]

23. Producer gas is a…….calorie gas mixture obtained by partial combustion (Reaction of air and stream) of biomass fuels and coal.

[Low]

24. Producer gas obtained from updraft gasifier contains large amount of ……. and ……. from the drying zone.

[Hydrolytic and water vapors]

25. In down draft gasifier fuel and gas moves in the ……. direction.

[Same]

26. In down draft gasifier the main area within the hearth is the …….

[Combustion zone]

27. In down draft gasifier air is blown through a ……. duct or a ……. of equally spaced tuyre nozzle around the furnace.

[Single or number]

28. In downdraft gasifier as the gas passes through the …….carrying flash and dirt are trapped and the gas is cleaned.

[Solid bed char]

29. In fluidized bed gasifier air is blown through ……. at a sufficient velocity to keep these in suspension.

[Solid particles]

30. Complete breakdown of tars is achieved in ……. gasifier.

[Down draft]

31. Large amount of tars and volatiles matters are thermally cracked in……. gasifier.

[Down draft]

32. In fluidized bed reactor fuel is pyrolysed…….

[Very fast]

33. Energy density of biomass depends upon its ……. as well as its……..

[Mass density, composition]

34. Efficiency for biogasification will depend upon the …….of the biomass materials.

[Proximate analysis]

35. Moisture influences the ……. in the various zones of the gasifiers.

[Temperature]

36. Too less moisture content in biomass causes …….of the gasifier and effects the composition of the producer gas.

[Overheating]

37. A moisture content of about ……. per cent by weight is desirable in biomass for trouble free and economical operations.

[15]

38. Excess moisture content in biomass has a determined effect on the …….of gasifier.

[Performance]

39. Volatile matter of biomass gets released when biomass is heated from ……. to …….

[100 to 500 ^{0}C]

40. Ash is ……. in combustion process.

[Detrimental]

41. Ash formation takes place both in …….and …….zone during gasification.

[Oxidation and Reduction]

42. Producer gas the impurity …… which needs removal before use in engines.

[Tar]

43. Hot wire anemometer is a device used to measure…….

[Gas velocities]

43. A chromatograph is used for analyzing the …….

[Composition of a gas]

44. The most common gas employed in gas chromatograph is…….

[Helium]

45. Orsat apparatus is used for……. of the flue gas.

[Volumetric analysis]

Part 7: Other Energy Sources

New Technologies:

The Govt. of India also takes the necessary steps to utilized the energy generated from new technologies namely.

1) Chemical sources of energy:

The main objective is the development and application of fuel cell technology, which produced electricity, water and heat through reaction between hydrogen and oxygen.

2) Hydrogen:

Hydrogen is the primary fuel for fuel cell. Fuel cells are ideally suited for decentralized power generation and other uses. Prototype of proton exchange membrane fuel cell (PEMFCS) and phosphoric acid fuel cells (PAFCS) have been developed in kilowatt size. The application of these prototypes has been demonstrated for power generation, industrial and transport sector.

3) Geothermal Energy.

The geothermal power generation programme has been initiated in the country. It can also be utilized for space heating, greenhouse cultivation, cooking etc. With support from Government the Geological survey of India is working on a comprehensive report on the assessment of geothermal resources potential for direct application and power generation.

4) Tidal Energy:

The ocean contains renewable energy in the form of temperature gradient, waves tides and ocean currents. Some potential sites can be developed further for utilization of tidal energy in the Gulf of Kuchch, Gulf of Cambay and the delta of Ganga in Sunderban area is under preparation.

Tidal Energy:

Advantages:

- The biggest advantage of the tidal power is besides being inexhaustible.
- Tidal power generating is free from pollution, as it does not use any fuel and also does not produce any unhealthy waste like gases, ash and atomic refuse.
- These power plants do not demand large area of valuable land because they are on the sea shore.
- Peak power demand can be effectively met when it works in combination with

thermal or hydroelectric system.

Disadvantages:

- Low duty cycle due to intermittent tidal flow.
- Huge modification of coastal environment.
- Very high costs for low duty cycle source.

Geothermal Energy:

Applications:

- Geothermal energy is used for generation of electric power.
- Geothermal energy is used for industrial process heat.
- Geothermal energy is used for space heating for various kinds of buildings.

Advantages:

- Geothermal energy is versatile in it use.
- It is cheaper, compared to the energies obtained from other sources both zero fuels and fossil fuels.
- Geothermal energy delivers greater amount of net energy from its system then other alternative or conventional systems.
- Geothermal power plants have the highest annual load factors 85 per cent to 90 per cent compared to 45 per cent to 50 per cent for fossil fuel plants.
- Geothermal energy is the least polluting compared to the other conventional energy sources.
- The greatest attraction of geothermal energy is its amenability for multiple uses from a single resource.
- Geothermal energy is the renewable resource that has practically no intermittency has the highest energy density, and is economically not far removed from conventional technologies.
- Geothermal energy from the earth's interior is almost as inexhaustible as solar or wind energy, so long as its sources are actively sought and economically tapped.
- Very high efficiency, low initial costs since already got steam.

Disadvantages:

- Non-renewable (more is taken out than can be put in by nature), highly local resource.

Hydro Energy:

Advantages:

- It is cheap, renewable source of energy with negligible environmental impact.
- Hydro power has benefits in terms of carbon dioxide emissions and air pollution, it also has significant negative environmental impacts.
- Very high efficiency i.e. 80%.
- Little waste heat.
- It is an attractive alternative to diesel system in rural and remote area of developing countries as a means of achieving rural electrification.
- Low cost per kWh, can adjust kWh output to peak loads, recreation dollars.
- Micro-hydro power has an important role to play in future energy supply scenarios, in developing country.

Disadvantages:

- Fish are endangered species, sediment buildup.
- Dam failure.
- Changes watershed characteristics, after hydrological cycle.

Hydrogen Burning:

Advantages:

- No waste products.
- Very high energy density.
- Good for space heating.

Disadvantages:

- No naturally occurring sources of Hydrogen.
- Needs to be separated from water via electrolysis which takes a lot of energy.
- Hydrogen needs to be liquefied for transport - takes more energy.

Ocean Thermal Energy Conversion:

Advantages:

- Enormous energy flows, steady flow for decades.
- It can be used on large scale.
- It exploits natural temperature gradient in the ocean.

Disadvantages:

- Enormous engineering effort.
- Extremely high cost.
- Damage to coastal environments.

OBJECTIVE QUESTIONS

1. The source of renewable energy is not dependent…….

[Geo thermal]

2. The most commonly used renewable energy source in the world is…….

[Hydro energy]

3. Geysers is example of…….energy

[Geothermal]

4. The water collected at high elevation contains ……. energy.

[Potential]

5. The efficiency of hydro electric power plant depends on effectiveness of …….

[Water turbine]

6. The pelton wheel is used where a…….of water is available.

[Small flow]

7. The Francis turbine is used where a ……. and high head of water is involved.

[Large flow]

8. The energy associated with sea or ocean such as ocean thermal energy conversion, The wind blowing on sea surface yields …….

[Wave energy]

Important objective questions of **ENGG-243**
Renewable Energy and Green Technology
By Dr.Wandre S. S.

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1. **Pyranometer:** It is used to measure total radiation (direct and diffuse) in terms of energy per unit time per unit area on a horizontal surface.

2. **Pyrheliometer:** It is used for measuring direct beam radiation. Solar energy is a very large, inexhaustible source of energy.

3. **Solar constant:** The rate at which energy reaches the earth's surface from the sun, usually taken to be 1,367 w/m^2.

4. **Inverter:** A device that converts direct current electricity to alternating current either for stand-alone systems or to supply power to an electricity grid.

5. **Photon:** A particle of light that acts as an individual unit of energy.

6. **Zenith angle:** The angle between the direction of interest (of the sun, for example) and the zenith (directly overhead).

7. **Langley:** Unit of solar irradiance. 1 Langley = 85.93 kwh/m^2.

8. At most about **75%** of the solar energy actually reaches the earth's surface.

9. **Anemometer:** Measures the wind speed and transmits wind speed data to the controller.

10. **Wind vane:** Measures wind direction.

11. **Insolation:** it the solar radiation that reaches the earths surface per square meter per minute.

12. **Deenbandhu plant** is modification and advance version of **Janta fixed dome type biogas plant**.

13. **Janta biogas** plant is **semicontinous flow** plant.

14. **Carbonisation:** also known as **pyrolysis** which is defined as breakdown of complex substances into simpler ones by heating in absence of air.

15. **Sun** is the source of all energy sources.

16. The calorific value of **natural gas is 50kJ/kg.**

17. The biogas consists of **CH_4 and CO_2** gases as chief constituents.

18. Amount of energy converted into work which is obtained from system is known as **energy efficiency.**

19. **Pyrolysis** is the basic **thermochemical process** for converting solid biomass to a more useful liquid fuels.

20. **Charcoal production** is a form of pyrolysis with **limited** available oxygen.

21. Pyrolysis process is mainly for production of solid fuel **char,** liquid fuel **tar** and gaseous fuel **hydrocarbonic gases**.

22. The digestion of organic matter in absence of air is known as **anaerobic digestion**.

23. The transformation of wood to charcoal is partially complete at **400-500°C.**

24. Gasifiers are classified according to the **air introduction** in the fuel column.

25. Gasification process is carried out in **4** different stages.

26. Actual combustion of char, pyrolysed gases and tars takes place in **oxidation** zone.

27. Gasifier converts **solid fuel into gaseous fuel.**

28. Combustible mixture of producer gas is **H_2 and CO_2.**

29. Air ratio required for gasification is **2.38 kg wood/kg air.**

30. Principal production in reduction zone is **CO.**

31. Calorific value of producer gas is **5506 KJ/Nm^3**

32. Gasifier found the most suitable for engine application is **downdraft gasifier.**

33. Density of briquettes normally varies between **1200-1400 kg/m^3 for** high pressure processes.

34. In the densification **volumetric efficiency** can be increased.

35. The PH range suitable for biogas production is **6.6-7.5.**

36. In the case of cattle dung the C/N ratio is usually around **25:1**.

37. **HRT** is the number of days the feed material is required to remain in the digester to begin gas production.

38. The optimum level of total solid for cattle dung slurry is in the range of **8-10%.**

39. **Janata and Deenbandhu models** are fixed dome type biogas plants.

40. The gas is available at a constant pressure in **KVIC type biogas plant**.

41. Calorific value of methane (biogas) is: **4713kcal/m^3**

42. Constant gas pressure available in **floating drum type biogas plant.**

43. Heart of biogas plant is **digester.**

44. Constituents of biogas is **CH_4 and CO_2.**

45. The gas available at a pressure of about 10 cm of water column in **KVIC model.**

46. Liquid flat plate collectors are generally used for obtaining hot water at temperature less than **100°C.**

47. In dish type solar cooker, temperature achieved at the bottom of the vessel is around **350-400°C.**

48. Dish type solar cooker is having thermal efficiency of around **40%.**

49. Insulation is provided to minimize **heat losses.**

50. In solar water distillation the water is evaporated because of **partial difference.**

51. A 100 liter solar water heater can saves about **2000 units of electricity annually.**

52. The required collector area for 50 litre hot water demand at $50^{o}C$ is about **$1m^{2.}$**

53. The capacity of solar water heating system can be boosted by **increasing collector area.**

54. Orientation of solar appliance is **south facing.**

55. Energy required for distilling 1 liter of brackish water **2260KJ.**

56. **Solar still** is a device used for converting brackish water into potable by **desalination principle.**

57. Solar photovoltaic technology is the direct conversion of **sun light into electricity.**

58. Solar cells are **semiconductor devices** that converts sunlight to direct current electricity.

59. A typical silicon PV cell produces about **0.5-0.6 Volt DC** under open circuit, no load conditions.

60. Wind is result of uneven heating of the **earth planet**

61. The power in the wind is proportional to the cube of its **velocity.**

62. **In horizontal axis** wind machine rotor weight is less.

63. Wind speed 5-6 km/hr is suitable to run **wind pump.**

64. The average capital cost of wind farm project works out to **Rs 3.5 to 4 crore.**

65. Power for lifting the water from wind mill= **$0.5A\underline{\rho}V^3C_p$**

66. The Water collected at high elevation contains **potential energy** which through downward moment of water converted **to kinetic energy.**

67. The efficiency of hydro-electric power plant depends on effectiveness of

water turbine.

68. The Pelton wheel is used where **small flow** of water is available.

69. The Francis turbine is used where a **large flow and high head** of water is involved.

70. A typical windmill starts lifting water at **12kmph wind speed** and yield about **30-35 m^3 of water** every day.

71. Enlist the methods of ethanol production**: 1) dry milling 2) wet milling**

72. The floating type biogas plant is **KVIC biogas plant**

73. The PH range of **6.8-7.8** is best for the fermentation and gas formation in biogas plant

74. 1 kg of dry cattle produce **1m^3** biogas

75. The formula formula for measuring output of solar still is= **ESA/2.3**

76. Enlist the zones of solar pond: **upper converting zone, non-converting zone, lower bottom converting zone**

77. The energy required to evaporation of water is (latent heat) **2260 KJ/Kg**

78. The effective conversion efficiency of solar cell is **10-15%**

79. Maximum temperature generated in solar box type cooker is **140^oC**

80. Single PV cell produce **0.5-0.6 V** DC current

81. Parabolic solar cooker used **unionized aluminium sheet** reflecting material

82. Minimum speed required to run wind pump is **5-6 km/hr**

83. Properties of biodiesel: **specific gravity 0.88, viscosity 7.5, center index 49, net heating value 33,300 kg/lit**

84. Write any two tree species which are used for biodiesel production: **Jatropha and Karanj**

85. KVIC (full form)=**Khadi and Village Industry Commission**

86. OTEC (full form)=**Ocean Thermal Energy Commission**

87. **Turbines** are used to convert wind energy to electrical energy

88. The temperature attained in parabolic solar cooker is **upto 400°C**

89. Define pyrolysis: **the process of conversion of complex organic polysaccharides substances to simple inorganic mono saccharides**

90. **Sodium methylate** catalyst is used during biodiesel production.

91. What type of energy is wind energy: **renewable energy**

92. Wind energy is harnessed as **mechanical energy** with the help of windmill or turbine.

93. Wind is beneficial resource of energy as it doesn't cause **pollution**

94. Black painted panels which are hanged at roofs to trap heat and energy from sun, are **solar heater**

95. Ocean thermal energy is due to **temperature difference at different levels in ocean**

96. The power generated in wind mill is depends **on wind velocity**

97. Which part of solar cooker is responsible for the green house effect: **glass cover**

98. The source of energy of the sun is **nuclear fusion**

99. The efficiency of the solar cooker can be increased by placing a **plane mirror**

100. A solar cell is made up of silicon

101. A solar cell converts solar energy into electrical energy

102. The temperature difference between the upper layers and the deeper layers of the ocean should be 20oC to install an OTEC power plant.

103. Which part of flat plate collectors is coated in black?: Absorber plate

104. The function of a solar collector is to convert Solar Energy to thermal energy

105. Reflecting mirrors used for exploiting solar energy are called **Heliostats**

106. The output of solar cell is of the order of **1W.**

107. Flat plate collector absorbs **direct and diffuse both radiations**

108. Temperature attained by a flat-plate collector is of the Order of about **90^0C**

109. The voltage of a single solar cell is **0.5 V**

110. The value of Solar Constant is **1367 W/m^2**

111. In the paraboloid dish concept, the concentrator tracks the sun by rotating about **2 axis**

112. Beam radiations are measured with **Pyrheliometer**

113. How many types are flat plate collectors divided depending on type of heat transfer fluid: **2 (two)**

114. Which part of flat plate collectors is coated in black**?: Absorber plate**

115. Horizontal axis and vertical axis are the types of: **Wind mills**

116. A fuel cell, in order to produce electricity, burns: **hydrogen**

117. Fuel cells are: **Hydrogen battery**

118. Lignite, bituminous and anthracite are different ranks of: **coal**

119. What are photovoltaic: Technologies which converts **solar radiation directly into electricity**

120. The region where the electrons and holes diffused across the junction is called **Depletion region**

121. Theoretical maximum efficiency of wind power is about: **59%**

Biogas technology

1) The decomposition of dung into combustible gas was first noticed and it was termed as **Gobar gas.**
2) The technology of harnessing gas under artificially created conditions is known as **Biogas technology.**
3) Cattle dung when passed the passed through a biogas unit , yields **30-40 %** more net energy and about **35-45%** more nitrogen in manure.
4) Biogas technology is the **Manure** producing factory.
5) Biogas technology gives **Combustible gas** for cooking purpose.
6) Biogas generation process carried out in the absence of **Oxygen.**
7) Biogas process produce organic manure in the form of **Digested slurry**.
8) In **Acid formation** reaction hydrolyzed mixture is converted into acid mixture.
9) Hydrolysis and acid formation stage are grouped as **Acid formation stage.**
10) Product of first two stages serve as the raw material for the third stage where organic acid are utilized as carbon source by methane forming micro-organisms, which are also known as **Methanogens**.
11) PH range for Methanogenesis is **6.8 to 7.5**
12) The optimum temperature of digester slurry in Mesophilic zone is **35`c.**
13) The design of biogas plant depends on prevailing temperature of **Retention** period of plant is decided.
14) In cooler areas **High** retention period is recommended.
15) In biogas formation the PH range below the **6.2** it become toxic.
16) In biogas formation optimum C/N ratio in the range of **25 to 30:1**
17) The optimum level for cattle dung slurry in the range of **8 to 10%.**
18) Percentage of carbon dioxide produced in biogas is the **38%.**
19) The calorific of value of methane in biogas production is **48 kcal/m3.**
20) **Digester** is the fermentation tank.
21) **Gas holder** is the floating drum.
22) **Batch digester** is the process of whole digester is filled with raw material for gas producing along with the some starting material.
23) **In 1945** scientist of IARI , New Delhi worked on semi-continous flow digester.
24) The Janta model is a fixed dome biogas plant which was developed by **PRAD in 1978** year.
25) The cost of Janta plant is about **20-30 %** less than KVIC floating drum type plant.
26) **Dinbandhu** is modification & advanced version of Janta fixed type biogas plant.
27) Dual fuel engine is in a position to make use of about **70%** biogas & **30%** diesel.
28) Optimum quantity of dung with water mixture is called as **Hydrolysis.**
29) The toterated PH range of methanogenes **is 6.8-7.5**
30) The optimum temp. of digester slurry in mesophilic zone **is 35`c.**

31) The optimum temp. of digester slurry in thermophilic zone is **55`c.**
32) Decay or decomposition is carried out by tiny micro-organisms called **Bacteria.**

33) The PH range suitable for biogas production is **6.6 to 7.5**
34) PH is also controlled by natural buffering effect **of NH4+ & HCO3-** ions.
35) The optimum C: N ratio of biogas is in the range of **25 to 30:1**
36) The full form of HRT **= Hydraulic Petention Time**.
37) Methane percentage in biogas **is 60%.**
38) Carbon dioxide contain in biogas is **38 %**
39) Nitrogen contain in biogas is **0.8 %**
40) Hydrogen sulphide contain in biogas **is 0.2 %.**
41) The calorific value of methane **is 4800 kcal/m3.**
42) The biogas gives a useful heat of **3000** kcal/m3.
43) IARI **– Indian Agriculture Research Institute.**
44) KVIC **– Khadi & Village Industries Commission**.
45) Janta plant is **a semi contionus** plant flow.
46) **Deenbandhu** plant is modification and advanced version of Janta plant.

Gasifier

1) **Gasification** is a step forward to carbonization , where end product of carbonization is finally converted into gaseous mixture of combustible nature.
2) An **Updraft gasifier** is clearly defined zones for partial combustion, reduction & pyrolysis.
3) The **Downdraft gasifier** was developed to convert high volatile fuel to low tar gas.
4) Twin-fire gasifier process takes place with under pressure of **-30.**
5) **Crossdraft gasifier** allow cross movement of fuel and gas.
6) In cross draft gasifier **Charcoal** is used as dry fuel.
7) In fluidized bed gasifier air is blown through a **Bed of solid particles** at a sufficient velocity.
8) **Drying** is the very first thermal reaction of gasification.
9) Air dried biomass contains moisture in the range of **13-15%.**
10) Temperature of drying zone is remain less than **120`c**.
11) Temperature for pyrolysis process is above **200`c.**
12) Normal temperature of primary pyrolysis zone is **200-600`c.**
13) Temperature range of secondary pyrolysis zone is **300-800`c.**
14) Actual combustion of char, pyrolysed gases and tars takes place in **Oxidation zone.**
15) Temperature range of oxidation is **900-1200`c.**
16) The product of oxidation zone are high temperature gases containing product and **Water vapour.**
17) The product of oxidation zone passes through **Reduction zone.**
18) Temperature limit of reduction zone is **900-800`c.**
19) Co-production is the principle reaction in the **reduction** zone.
20) H2 combines with carbon to form **Methane.**
21) The first process of gasification is **Drying.**
22) The second process of gasification is **Pyrolysis**.
23) The third process of gasification is **Oxidation.**
24) The fourth process of gasification **is Reduction.**
25) The temperature of drying process remains **less than 120`c.**
26) The temperature of primary pyrolysis zone is **200`c-600`c**.
27) The temperature of secondary pyrolysis zone is **300-800`c.**
28) The temperature of oxidation process zone is **900-1200`c.**
29) The temperature of primary pyrolysis zone **is 900-800`c.**

Solar drying

1) Dryers are classified as **Direct** as well as indirect type of solar dryer.
2) **Drying** is the universal method for preserving food.
3) The international nature of solar radiation cannot affect the drying performance at **Low temp.**
4) Dried product not only has increased shelf life but also reduce cost of **Transportation & Storage.**
5) The removal of moisture require **only Low temperature** heating.

Solar photo-voltic system

1) Group of PV cell are electrically configured into **Module and arrays**.
2) A typical silicon PV cell produce about **0.5-0.6** volt De under open circuit no load condition.
3) A PV array produce energy power when exposed to **sunlight.**
4) A PV cell is **fundamental building** block of PV system.
5) PV system can be used either **centralized** or **distributed** power generation.

Wind Energy

1) The wind energy is vary **diffuse** in nature.
2) India ranks **Fourth** in the world in wind power generation.
3) India has estimated wind power potential of **45, 195 MW.**
4) World largest wind from are in **California.**
5) Doubling the wind speed will increase the available power **8** times.
6) The simplest vertical axis WECS is **the Savonius type** rotar.

Some other Renewable sources of energy

1) The total cattle population in country is **about 250 million**.
2) The sewage biogas is found to contain **84%** Methane.
3) The surface of water is act as the collector for **solar heat.**
4) The periodic rice full in water level is called **Tide**.
5) To harness the tides a **dam** would be built across the **mouth** of the dry.
6) Hydrogen can be substituted for **hydrocarbon**.
7) Hydrogen burning process is **non polluting.**
8) **Geo- thermal energy** is the energy lies embedded within the earth.
9) Now the world's first Geo themal power station produce**s 460 MW** power.