Chemist and Metallurgist

1. An electrostatic precipitator is normally used for separating particles from gases when

(1) particle size is greater than 1 mm
(2) particle size is less than 1 micorn
(3) gases contain high concentration of carbon monoxide
(4) gases contain high concentration of solids

Ans: 2

2. The Weber number can be used to estimate

(1) ratio of inertial and surface tension forces
(2) ratio of inertial and compressibility forces
(3) ratio of inertial and centrifugal forces
(4) ration of pressure and surface tension forces

Ans: 1

3. Indirect contact heat exchangers are preferred over direct heat exchangers because

(1) Heat transfer co-efficient are high
(2) There is no risk of contamination due to mixing
(3) There is no mist formation
(4) Cost of equipment is lower

Ans: 2

4. Which of the following fuels has the highest calorific value per unit mass?

(1) Coal (2) Kerosene (3) Natural gas (4) Furnace oil

Fuel Oil	Gross Calorific Value (kCal/kg)
Kerosene -	11,100
Diesel Oil –	10,800
L.D.O -	10,700

Furnace Oil - 10,500 LSHS - 10,600
https://beeindia.gov.in/sites/default/files/2Ch1.pdf
Indian coal - 4000 to 6000
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HTTP://CNGEUROPE.COM/FUEL-CALORIFIC-VALUES/

FUEL CALORIFIC VALUES

The calorific value of a fuel is the quantity of heat produced by its combustion – at constant pressure and under

"normal" (standard) conditions (i.e. to 0ºC and under a pressure of 1,013 bar).

The combustion process generates water vapor and certain techniques may be used to recover the quantity of heat contained in this water vapor by condensing it.

- Higher Calorific Value (or Gross Calorific Value – GCV, or Higher Heating Value – HHV) – the water of combustion is entirely condensed and that the heat contained in the water vapor is recovered;
- Lower Calorific Value (or Net Calorific Value – NCV, or Lower Heating Value – LHV) – the products of combustion contains the water vapor and that the heat in the water vapor is not recovered.

Fuel Calorific Values

Natural gas	12500 kcal/kg
Propane-butane	11950 kcal/kg
Disel	10000 kcal/kg
Fuel oil	9520 kcal/kg
Brown coal	3500 kcal/kg
Woods	2500 kcal/kg
Electricity	860 kcal/kWh

Composition of Natural Gas

Methane CH_4	70-90%
Ethane C_2H_6	0-20%
Propane C_3H_8	Butane C_4H_{10} Carbon Dioxide CO_2 0-8%
Oxygen O_2	0-0.2%
Nitrogen N_2	0-5%
Hydrogen sulphide H_2	S 0-5%
Rare gasesA, He, Ne, Xe	trace

……..

HEAT VALUES OF VARIOUS FUELS

The heat value of a fuel is the amount of heat released during its combustion. Also referred to as energy or calorific value, heat value is a measure of a fuel's energy density, and is expressed in energy (joules) per specified amount (***e.g.*** kilograms).

	Heat value
Hydrogen (H_2)	120-142 MJ/kg
Methane (CH_4)	50-55 MJ/kg
Methanol (CH_3OH)	22.7 MJ/kg
Dimethyl ether - DME (CH_3OCH_3)	29 MJ/kg
Petrol/gasoline	44-46 MJ/kg
Diesel fuel	42-46 MJ/kg
Crude oil	42-47 MJ/kg
Liquefied petroleum gas (LPG)	46-51 MJ/kg
Natural gas	42-55 MJ/kg
Hard black coal (IEA definition)	>23.9 MJ/kg
Hard black coal (Australia & Canada)	c. 25 MJ/kg

Sub-bituminous coal (IEA definition)	17.4-23.9 MJ/kg
Sub-bituminous coal (Australia & Canada)	c. 18 MJ/kg
Lignite/brown coal (IEA definition)	<17.4 MJ/kg
Lignite/brown coal (Australia, electricity)	c. 10 MJ/kg
Firewood (dry)	16 MJ/kg

https://world-nuclear.org/information-library/facts-and-figures/heat-values-of-various-fuels.aspx

5. Which of the following fuels has the highest calorific value per unit mass?

(2) Coal (2) Kerosene (3) Natural gas (4) Furnace oil

Ans: 4

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https://world-nuclear.org/information-library/facts-and-figures/heat-values-of-various-fuels.aspx

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Also refer https://www.engineeringtoolbox.com/fuels-higher-calorific-values-d_169.html

6. The most widely used coagulant for removing suspended impurities from water is

(1) Bleaching power (2) Chlorine
(3) Calcium sulphate (4) Alum

Ans: 4

7. Ideal gas law is applicable at

(1) low temperature, low pressure (2) high temperature, high pressure
(3) low temperature, high pressure (4) high temperature, low pressure

Ans: 4

8. For an ideal fluid flow the Reynolds number is

(1) 2100 (2) 100 (3) 0 (4) infinity

Ans: 4

9. A solid is transformed into vapour without going through the liquid phase at

(1) triple point
(2) boiling point
(3) below triple point
(4) always

Ans: 1

10. The kinetic energy of gas molecule is zero at

(1) 0°C (2) 279°C (3) 100°C (4) -273°C

Ans: 4

11. Styrene-Butadiene rubber is commercially manufactured by

(1) Bulk polymerization
(2) Suspension polymerization
(3) Solution polymerization
(4) Emulsion polymerization

Ans: 2

12. When an unsaturated air-water mixture is heated at constant pressure, then

(1) partial pressure of water vapour increases
(2) specific humidity decreases
(3) relative humidity increases
(4) relative humidity decreases

Ans: 4

13. According to the kinetic theory, the thermal conductivity of a monoatomic gas is proportional to

(1) T (2) $T^{0.5}$ (3) $T^{1.5}$ (4) T^{2}

Ans: 2

14. The preferred material of construction for storage tanks for 98% sulphuric acid is

(1) Aluminium
(2) Lead
(3) Stainless steel 316
(4) Mild steel

Ans: 2

15. A Carnot cycle consists of the following steps

(1) two isothermals and two isentropics
(2) two isobars and two isothermals
(3) two isochorics and two isobar isochorics
(4) tow isothermals and two isochorics

Ans: 1

Fig…

16. Gibbs phase rule finds application when the heat transfer occurs by

(1) Conduction (2) Convection (3) Radiation (4) Condensation

Ans: 4

17. For hydrogen and hydrogen like single electron systems, the energy and size of an orbital is determined exclusively by

(1) principal quantum number
(2) principal and spin quantum numbers
(3) spin and magnetic quantum numbers
(4) magnetic and principal quantum numbers

Ans: 1

18. Which one of the following statements is correct?

(1) All ferroelectric solids are piezoelectric too
(2) All piezoelectric solids are ferroelectric too
(3) Bohr magneton is the unit of dipole moment
(4) Glass is an alloy

Ans: 1

19. Which is the property that generally increases from left to right and decreases from top to bottom in the periodic table?

(1) Covalent radius
(2) Atomic weight
(3) Electronegativity
(4) Ionic radius

Ans: 3

20. Naturally occurring carbon consists of

(1) 2 stable isotopes and radioactive isotope
(2) one stable isolate and two radioactive
(3) one stable isotope and one radioactive isotope
(4) two stable isotopes and two radioactive isotopes

Ans: 1

21. Which of the following is diamagnetic?

(1) F_2 (2) O_2 (3) N_2 (4) Both (1) and (2)

Ans: 4

22. Which pair has the same atomic radius for both the elements?

(1) Li and Na (2) Ag and Au (3) Ag and Cu (4) P and AS

Ans: 2

23. When pure water is kept exposed to the atmosphere for a few days, what happens to its pH?

(1) Increases to a level atleast 2 or 3 units above 7
(2) Decreases slightly from 7
(3) Remains unchanged
(4) None

Ans: 2

24. In a DNA structure, how many hydrogen bonds are formed between Adenine and Thymine?

(1) 4 (2) 3 (3) 2 (4) 1

Ans: 3

25. The alpha particles cause luminescence on striking a

(1) Sodium sulphide screen (2) Potassium sulphide screen

(3) Zinc sulphide screen (4) Copper sulphide screen

Ans: 3

26. Silica in any form is

(1) Reactive (2) Unreactive
(3) Highly reactive (4) Inert

Ans: 2

27. The metal which does not give H_2 on reaction with dil. HCl is

(1) Iron (2) Zinc (3) Calcium (4) Silver

Ans: 4

28. Brown ring test is used for the detection of …..radical

(1) Nitrite (2) Nitrate (3) Sulphate (4) Sulphide

Ans: 2

29. The total number of quantum numbers needed to describe an electron in an atom is

(1) 4 (2) 3 (3) 2 (4) 1

Ans: 1

30. The compounds having same molecular formula but possessing different properties that result from a difference in structure are termed as

(1) Hydrocarbons (2) Isomers
(3) Carbon chain compounds (4) None of the three are correct

Ans: 2

31. What is the major component of permanent type of antifreeze for automobile cooling system?

(1) Ethyl alcohol (2) Ethylene glycol
(3) Methanol (4) Ether

Ans: 2

32. A process is said to be _____ if the pressure remains unchanged during the process

(1) Cyclic
(2) Isothermal
(3) Isobaric
(4) Isochoric

Ans: 3

33. Atoms with nearly filled shells of electrons will tend to have higher

(1) Electro positivity
(2) Electro negativity
(3) Electron affinity
(4) Resonance energy

Ans: 2

34. A mixture of carbon dioxide and hydrogen obtained in a process is called

(1) Solid gas
(2) Carbon gas
(3) Hydrogen gas
(4) Water gas

Ans: 4

35. Which type of bond is present in hydrogen molecule?

(1) Ionic
(2) Covalent
(3) Hydrogen
(4) Metallic

Ans: 2

36. Marsh test is used for the detection of

(1) Cadmium
(2) Bismuth
(3) Arsenic
(4) Copper

Ans: 3

37. Absolute zero may be defined as the temperature at which

(1) Molecular motion in a gas would cease
(2) all substances freeze
(3) water freezes
(4) a liquid is converted into solid

Ans: 1