1. Which one of the following is the fluid whose properties in all its three phases are made use of in thermodynamics?

(A) Freon

(B) Helium

(C) Water

(D) Ammonia

2. The cyclic integral of $(\delta Q - \delta W)$ for a process is

(A) negative

(B) zero

(C) unpredictable

(D) positive

3. Change in enthalpy in a closed system is equal to heat transferred, if the reversible process takes place at constant

(A) internal energy

(B) pressure

(C) entropy

(D) temperature

4. Which one of the following thermodynamic processes approximates the steaming of food in a pressure cooker?

(A) Isobaric

(B) Isochoric

(C) Isothermal

(D) Isenthalpic

5. "Heat cannot be transported from a system at low temperature to another system at high temperature without the aid of external agency." This statement of second law is attributed to

(A) Clausius

(B) Max Planck

(C) Joule-Thomson

(D) Gay-Lussac

6. Second law of thermodynamics defines

(A) enthalpy

(B) efficiency

(C) internal energy

(D) entropy

7. When a real gas undergoes Joule-Thomson expansion, the temperature

(A) always increases

(B) may increase or decrease

(C) always decreases

(D) may remain constant

8. Use of pulverized coal in boiler furnace provides

(A) better combustion

(B) less corrosion on furnace walls

(C) high calorific value

(D) smokeless burning

9. Blowing down of boiler water is the process to

(A) increase the steam temperature

(B) control the solid concentration in the boiler water

(C) control the drum level

(D) reduce the boiler pressure

10. A device which is used to drain off water from steam pipes without escape of steam is called

(A) steam trap

(B) pressure reducing valve

(C) injector

(D) steam separator

11. The amount of water evaporated from and at 100 °C into dry saturated steam at atmospheric pressure is called

(A) equivalent evaporation

(B) generation factor

(C) boiler horsepower

(D) evaporative capacity

12. A correctly designed convergent-divergent nozzle working at designed load is

(A) always choked

(B) never choked

(C) never isentropic

(D) always isentropic

13. What is the critical pressure ratio for isentropic nozzle flow with ratio of specific heats as 1·5?

(A) $(0 \cdot 8)^{0 \cdot 6}$

(B) $(1 \cdot 25)^{0 \cdot 33}$

(C) $(1 \cdot 25)^{3}$

(D) $(0 \cdot 8)^{3}$

14. Which of the following statements is/are true in relation to choked flow through a nozzle?

1. Discharge is maximum.
2. Discharge is zero.
3. Velocity at throat is supersonic.
4. Nozzle exit pressure is less than or equal to critical pressure.

Select the correct answer using the codes given below.

(A) Both 1 and 3

(B) Both 2 and 3

(C) Both 1 and 4

(D) 1 only

15. Shock waves involving abrupt rise of pressure increase of entropy genera occur

(A) in the convergent section the nozzle

(B) at the nozzle throat

(C) in the divergent section o the nozzle

(D) at entry to the nozzle

16. Which of the following is a pressure compounded turbine?

(A) Parsons

(B) Curtis

(C) Rateau

(D) All of the above

17. In Parsons' reaction turbine, the velocity diagram triangles at the inlet and outlet are

(A) isosceles

(B) right angled

(C) congruent

(D) asymmetrical

18. The isentropic enthalpy drop in moving blade is two-third of the isentropic enthalpy in fixed blades of a turbine. The degree of reaction will be

(A) 0·6

(B) 0·66

(C) 1·66

(D) 0·4

19. The breeder ratio for a breeder type reactor

(A) is unity

(B) is more than unity

(C) tends to infinity

(D) is less than unity

20. Identify the type of nuclear reactor that does not require a heat exchanger.

(A) Sodium-cooled

(B) Boiling water

(C) Pressurized water

(D) Gas-cooled

21. For the same compression ratio and heat input, the cycle in decreasing order of thermal efficiency is

(A) Diesel, Otto, Dual

(B) Dual, Diesel, Otto

(C) Otto, Diesel, Dual

(D) Otto, Dual, Diesel

22. Morse test is conducted only on

(A) low-power engines

(B) multi-cylinder engines

(C) water-cooled engines

(D) variable speed engines

23. Which of the following identifies the anti-knock quality of diesel fuel?

(A) API gravity

(B) Octane number

(C) Cetane number

(D) SAE number

24. In a reciprocating compressor, one should aim at compressing the air

(A) isentropically

(B) isothermally

(C) polytropically

(D) adiabatically

25. The suction pressure is 1 bar and the delivery pressure is 125 bar. What is the ideal intermediate pressure at the end of first stage for a 3-stage air compressor?

(A) 5 bar

(B) 10 bar

(C) 20 bar

(D) 25 bar

26. Which one of the following types of impeller vanes is most commonly used in centrifugal type impellers?

(A) Radial

(B) Backward curved

(C) Tangential

(D) Forward curved

27. In a gas turbine cycle, the turbine output is 600 kJ/kg, the compressor work is 400 kJ/kg and the heat supplied is 1000 kJ/kg. The thermal efficiency of the cycle is

(A) 40%

(B) 60%

(C) 80%

(D) 20%

28. In a gas turbine cycle with regeneration

(A) work output decreases

(B) thermal efficiency increases

(C) heat input increases

(D) pressure ratio increases

29. For a steady incompressible flow, the u-component of velocity is given as $u = Ae^x$. The corresponding v-component of velocity is

(A) $Ae^x y$

(B) $-Ae^x y$

(C) $-Ae^x$

(D) Ae^y

30. In the boundary layer, the flow is

(A) inviscid and irrotational

(B) inviscid and rotational

(C) viscous and irrotational

(D) viscous and rotational

31. What is the commonly used boundary layer control method to prevent separation?

(A) Using large divergence angle in the boundary

(B) Suction of accelerating fluid within the boundary

(C) Suction of retarded fluid within the boundary

(D) Use of smooth boundary

32. Which one of the following dimensionless numbers identifies the compressibility effect of a fluid?

(A) Froude number

(B) Mach number

(C) Weber number

(D) Euler number

33. The movable wicket gates of a reaction turbine are used to

(A) control the pressure under which the turbine is working

(B) strengthen the casing of the turbine

(C) reduce the size of the turbine

(D) control the flow of water passing through the turbine

34. Consider the following energies associated with a Pelton turbine :

1. Mechanical
2. Kinetic
3. Potential

The correct sequence of energy conversion starting from the entry fluid is

(A) 2–3–1

(B) 3–2–1

(C) 1–3–2

(D) 1–2–3

35. Kaplan turbine is

(A) a low head axial flow turbine

(B) an outward flow reaction turbine

(C) an impulse inward flow turbine

(D) a high head mixed flow turbine

36. The specific speed N_s of a water turbine is expressed by which of the following expressions?

(A) $N_s = \frac{N\sqrt{P}}{H^{3/4}}$

(B) $N_s = \frac{N\sqrt{Q}}{H^{5/4}}$

(C) $N_s = \frac{N\sqrt{Q}}{H^{3/4}}$

(D) $N_s = \frac{N\sqrt{P}}{H^{5/4}}$

37. The specific speed of a centrifugal pump is given by

(A) $\frac{N\sqrt{P}}{H^{5/4}}$

(B) $\frac{N\sqrt{Q}}{H^{5/4}}$

(C) $\frac{N\sqrt{H}}{Q^{3/4}}$

(D) $\frac{N\sqrt{Q}}{H^{3/4}}$

38. Fluid flow machines are using the principle of either *(i)* supplying energy to the fluid or *(ii)* extracting energy from the fluid. Some fluid flow machnies are combination of both *(i)* and *(ii)*. They are classified as

(A) hydraulic turbines

(B) torque converters

(C) windmills

(D) compressors

39. A composite wall of a furnace has two layers of equal thickness having thermal conductivities in the ratio 3 : 2. What is the ratio of the temperature drop across the two layers?

(A) 3 : 2

(B) 1 : 2

(C) $\log_e 2 : \log_e 3$

(D) 2 : 3

40. Which one of the following expresses the thermal diffusivity of a substance in terms of thermal conductivity k, mass density ρ and specific heat C?

(A) $\frac{1}{\rho k C}$

(B) $\frac{k}{\rho C}$

(C) $\frac{\rho C}{k^2}$

(D) $\rho^2 k C$

41. Fins are made as thin as possible to

(A) accommodate more number of fins

(B) increase the width for the same profile area

(C) improve the flow of coolant around the fin

(D) reduce the total weight

42. A refrigerator working on a reversed Carnot cycle has a COP of 4. If it works as a heat pump and consumes 1 kW, the heating effect will be

(A) 4 kW

(B) 5 kW

(C) 6 kW

(D) 1 kW

43. In vapour compression refrigeration system, at entrance to which component the working fluid is superheated vapour?

(A) Condenser

(B) Compressor

(C) Expansion valve

(D) Evaporator

44. In a vapour absorption refrigerator, heat is rejected in

(A) generator only

(B) absorber only

(C) condenser and absorber

(D) condenser only

45. What is an azeotrope?

(A) A refrigerant dissolved in alcohol

(B) A mixture of refrigerants without phase separation

(C) An eco-friendly refrigerant

(D) A non-halogenic refrigerant

46. Global warming is caused by

(A) carbon dioxide

(B) nitrogen

(C) carbon monoxide

(D) ozone

47. The most common type of absorption system in use in industrial applications is based on the refrigerant absorbent combination of

(A) lithium bromide-air

(B) carbon dioxide-water

(C) ammonia-water

(D) air-water

48. In aqua-ammonia and Li-Br water absorption systems, the refrigerants are respectively

(A) water and Li-Br

(B) ammonia and Li-Br

(C) ammonia and water

(D) water and water

49. Which one of the following is the extensive property of a thermodynamic system?

(A) Pressure

(B) Temperature

(C) Density

(D) Volume

50. Zeroth law of thermodynamics forms the basis of measurement.

(A) temperature

(B) heat exchange

(C) work

(D) pressure