Objective Paper-I-2013

1. In a reciprocating pump, air vessels are used to
   (A) smoothen the flow
   (B) reduce suction head
   (C) increase delivery head
   (D) reduce acceleration head

2. Consider the following statements pertaining to centrifugal pumps:
   1. The inlet to the impeller of a centrifugal pump is always axial, while the outlet may be radial or inclined.
   2. The impeller may be shrouded on both sides with an eye at the centre and vanes curved backwards.
   3. Impeller of double entry type has a balanced radial thrust.
   4. Un-shrouded and part shrouded impeller are used only where high efficiency is unimportant.
   Which of these statements are correct?
   (A) 1, 2, 3 and 4
   (B) 1, 2 and 3 only
   (C) 1, 2 and 4 only
   (D) 2, 3 and 4 only

3. A centrifugal pump is fully primed, but on starting it fails to deliver fluid. The probable reasons are listed below:
   1. Leaky foot valve or suction line
   2. Suction head is very low
   3. Insufficient motor speed
   4. Damaged or closed delivery valve
   Which of these reasons are correct?
   (A) 1, 2, 3 and 4
   (B) 1, 2 and 3 only
   (C) 2, 3 and 4 only
   (D) 1, 3 and 4 only

4. For a given centrifugal pump
   (A) Head varies inversely as square of speed
   (B) Discharge varies directly as speed
   (C) Discharge varies directly as square of speed
   (D) Power varies directly as fifth power of speed

5. A centrifugal pump is to discharge $0.118 \ m^3/s$ at a speed of 1450 rpm against a head of 25m. The impeller diameter is 25cm, its width at outlet is 5 cm and manometric efficiency is 75%. The vane angle at outer periphery of impeller is
   (A) 56.77°C   (B) 59.77°C   (C) 61.77°C   (D) 48.77°C

6. A turbine is working under a head of 200m. The power developed by the turbine is 100 kW and discharge through the turbine is $0.125 \ m^3/s$. In such case, the ratio of unit power to unit discharge for the turbine will be
   (A) 4000   (B) 16000   (C) 160 x 10^3 (D) None

7. Two geometrically similar pumps are running at 1000 rpm speed (both). If one pump has impeller diameter of 0.3m and discharges 20 LPM against 20 head, and the other pump gives half of this discharges rate; calculate head and diameter of second pump
   (A) 12.5 m and 0.12 m
   (B) 10.5 m and 0.12 m
   (C) 10.5 m and 0.23 m
   (D) 12.5 m and 0.23 m

8. The component of torque converter that allows torque multiplication is
    (A) Turbine   (B) Impeller   (C) Stator   (D) Freewheel

9. Which of the following statements are correct with respect to regenerative feed heating in a steam cycle?
    1. It increases cycle efficiency
    2. It increases specific output
    3. It reduces the condenser load
    4. It improves the steam quality   at the end of expansion
    (A) 1 and 3 only   (B) 2 and 4 only   (C) 2 and 3 only   (D) 1,2,3 and 4

10. Consider the following statements:
    Isentropic flow through a steam nozzle becomes 'choked' when
    1. Discharge is maximum
    2. Discharge is zero
    3. Nozzle pressure ratio is $\leq$ critical pressure ratio
    4. Throat velocity reaches sonic value
    Which of these statements are correct?
    (A) 1, 2, 3 and 4   (B) 1, 2 and 3 only
    (C) 2, 3 and 4 only   (D) 1, 3 and 4 only

11. Frictional losses in the nozzle
    (A) reduces the enthalpy of the fluid
    (B) increases the enthalpy of the fluid
    (C) no effect on enthalpy of the fluid
    (D) none of the above

12. In a nozzle designed for maximum discharge conditions, the flow velocity in the convergent section of the nozzle is
    (A) Subsonic
    (B) Sonic
    (C) Supersonic
    (D) Depends on initial pressure and condition of steam

13. The risk of radioactive hazard is greatest in the turbine with following reactor
    (A) pressurized water   (B) boiling water
    (C) Gas cooled   (D) liquid metal cooled

14. Without reducing the fluid flow rate, the speed of an impulse steam turbine can be brought down to practical limits by which of the following methods?
    (1) Large flywheel
    (2) Centrifugal governor
    (3) Velocity compounding
    (4) Steam bleeding
   (A) 1, 2 and 3   (B) 2,3 and 4   (C) 2 only   (D) 3 only

15.   To improve the quality of steam at turbine exit which of the following will be used?
1.   Reheat cycle
2.   Increase the maximum pressure when maximum and minimum temperatures are fixed
3.   Use superheated steam, instead of saturated steam when the maximum and minimum pressures are fixed
(A) 1,2 and 3   (B) 1 and 2 only   (C) 1 and 3 only   (D) 2 and 3 only

16.   In the centrifugal compressor the work input is equal to sum of
(A) Pressure head, relative head and dynamic head
(B) Dynamic head, centrifugal head and relative head
(C) Pressure head, centrifugal head and dynamic head
(D) Pressure head, centrifugal head and relative head.

17.   For a centrifugal compressor with radial vanes, slip factor is the ratio of
(A) Isentropic work to Euler work
(B) Whirl velocity to the blade velocity at the impeller exit
(C) Stagnation pressure to static pressure
(D) Isentropic temperature rise to actual temperature rise

18.   The specific speed of a centrifugal compressor is generally
(A) less than that of reciprocating compressor
(B) independent of compressor type, but depends only on size of compressor
(C) higher than that of axial compressor
(D) more than specific speed of reciprocating compressor but less than axial compressor

19.   In a centrifugal compressor, the highest Mach number leading to shock wave in the fluid flow occurs at
(A) Diffuser inlet radius   (B) diffuser outlet radius
(C) Impeller inlet radius   (D) impeller outlet radius

20.   In a centrifugal compressor, an increase in speed at a given pressure ratio causes
(A) increase in flow and increase in efficiency
(B) increase in flow and decrease in efficiency
(C) decrease in flow and increase in efficiency
(D) decrease in flow and decrease in efficiency

21.   In an axial flow compressor, the ratio of pressure rise in the rotor blades to the pressure rise in the compressor in one stage is known as
(A) Pressure coefficient   (B) Work factor
(C) Degree of reaction   (D) Slip factor

22.   The thermal efficiency of a simple open gas turbine plant is improved by regeneration as this
(A) Decreases the temperature of the gases at the turbine inlet
(B) Decreases the quantity of heat supplied in combustion chamber
(C) Increases the turbine output
(D) Lowers the work input to compressor

23.   The unit of the following property is not m^2/s
(A) Thermal diffusivity   (B) kinematic viscosity
(C) Dynamic viscosity   (D) mass diffusivity

24. In an ideal vapour compression refrigeration cycle the refrigeration effect is 80kJ/kg of refrigerant flow. The COP is 4. If the flow of the refrigerant is 2 kg/s, the heat rejected in the condenser is
    (A) 50 kW   (B) 100 kW   (C) 150 kW   (D) 200 kW

25. In the expansion valve of a refrigerator the following property remains constant
    (A) Entropy   (B) enthalpy
    (C) Internal energy   (D) product PV

26. The Poisson's equation the general conduction heat transfer applies to the case
    (A) Steady state heat conduction with heat generation
    (B) Steady state heat conduction without heat generation
    (C) Unsteady state heat conduction without heat generation
    (D) Unsteady state heat conduction with heat generation

27. A plane slab of 100 mm thickness generates heat. It is observed that the temperature drop between the centre and its surface to be $50°C$. If the thickness is increased to 20 cm the temperature difference will be
    (A) 100°C   (B) 200°C   (C) 400°C   (D) 600°C

28. Three fins of equal length and diameter but made of aluminium, brass and cast-iron are heated to $200°C$ at one end. If the fins dissipate heat to the surrounding air at $25°C$ the temperature at the free end will be least in case of
    (A) Aluminium fin
    (B) Brass fin
    (C) Cast-iron fin
    (D) Each fin will have the same temperature at the free end

29. The saturation temperature of water vapour at its partial pressure is equal to
    (A) Wet bulb temperature
    (B) Dew point temperature
    (C) Adiabatic saturation temperature
    (D) Dry bulb temperature

30. Hot air at $150°C$ flows over a flat plate maintained at $50°C$. If the forced convection heat transfer coefficient is 75 W/m^2 K, the heat gain rate by the plate through an area of 2 m^2 will be
    (A) 15 kW   (B) 22.5 kJ/S   (C) 7.5 kJ/S   (d) None

31. Which of the following statements are correct for a blackbody?
    1. A blackbody continues to emit radiation even when it is in thermal equilibrium with its surroundings.
    2. A blackbody is a perfect emitter.
    3. Absorptivity, $\alpha = 1$ represent a black surface.
    (A) 1 and 2 only   (B) 1 and 3 only   (C) 1, 2 and 3   (D) 2 and 3 only

32. What is next radiant interchange per square meter for two very large plates at temperature 800 K and 500K respectively? Emissivities of hot and cold plates are 0.8 and 0.6 and Stefan-Boltzmann constant is $5.67 \times 10^{-8} \, W/m^2.K^4$

   (A) $1026 kW/m^2$ (B) $10.26 kW/m^2$ (C) $102.6 kW/m^2$ (D) $1.026 kW/m^2$

33. Uniform heat generation takes place in a symmetric slab so that heat flows towards both sides in contact with fluid. The zero-gradient boundary condition $\frac{\partial T}{\partial x} = 0$ occurs at

   (A) left wall of slab   (B) right wall of slab
   (C) Centerline of slab   (D) nowhere in slab

34. A refrigerator operating on standard vapour compression cycle has $COP = 5.5$ and is driven by 40 kW compressor. Saturated liquid and saturated vapour enthalpies at condensing temperature of 30°C are 69.55 kJ/kg and 201.45 kJ/kg respectively. Saturated refrigerant vapour leaving the evaporator has enthalpy of 187.53 kJ/kg. Find refrigerant temperature at compressor discharge. (Take cp of refrigerant vapour as 0.6155 kJ/kg K.

   (A) 40.2°C   (B) 41.2°C   (C) 42.2°C   (D) 43.2°C

35. In a 3 ton capacity water cooler, water enters at 30°C and leaves at 15°C steadily. What is the water flow rate per hour?

   (A) 60 kg   (B) 100 kg   (C) 602 kg   (D) 2520 kg

36. In a vapour compression cycle, a good refrigerant should have a
   (A) large latent heat of vaporization at condenser pressure
   (B) large latent heat of evaporator Pressure
   (C) condenser pressure close to critical pressure
   (D) low critical pressure

37. It is not a cause for discouragement of the use of Chlorofluorocarbon (CFC) refrigerants in domestic refrigerators and air-conditioners for
   (A) their ozone depletion potential
   (B) their global warming potential
   (C) their tendency to migrate to the upper atmosphere by molecular diffusion
   (D) their toxicity and non-availability

38. The room sensible heat loss is 30,000 kJ/h and the latent heat loss is 20,000 kJ/h. Then the sensible heat factor is
   (A) - 0.6   (B) 0.6   (C) 0.3   (D) 3.0

39. When unsaturated air is adiabatically saturated, which of the following properties decrease?
   1. Dry bulb temperature
   2. Wet bulb temperature
   3. Relative Humidity
   4. Specific Humidity
   (A) 1 only   (B) 1 and 2 only   (C) 2 and 3 only   (D) 3 and 4 only

40. It is desired to condition the outside air from 80% relative humidity and 45°C humidity and 25°C dry bulb temperature. The practical arrangement will be
    (A) Heating and humidification   (B) heating and dehumidification
    (C) Cooling and humidification   (D) cooling and dehumidification

41. Which parameters are the independent variables in the construction of psychometric plot for a particular value of barometric pressure?
    (A) Dry bulb temperature and specific humidity
    (B) Wet bulb temperature and relative humidity
    (C) Dry bulb temperature and wet bulb temperature
    (D) Dry bulb temperature and enthalpy

42. If air at 20°C is heated to 25°C using heater with a surface temperature of 30°C then, the by-pass factor is
    (A) 2.0   (B) 0.5   (C) 1.0   (D) None

43. The atmospheric air at dry bulb temperature 15°C enters a heating coil maintained at 40°C If the air leaves the heating coil at 30°C, the coil efficiency is equal to
    (A) 0.2   (B) 0.4   (C) 0.6   (D) 0.75

44. In the air-conditioned space, fan load is considered as
    (A) Latent heat gain
    (B) Sensible heat gain
    (C) Both sensible and latent heat gain
    (D) Not considered as load

45. Equal friction method for designing air-conditioning duct.
    (A) Ensures constant static pressure at all terminals in the duct
    (B) Ensures same velocity in the duct all through in all branches
    (C) Automatically reduces the air velocity in the duct in the direction of flow
    (D) Does none of the above

46. In a differential manometer a head of 0.6 m of fluid A in limb 1 is found to balance a head of 0.3 m of fluid B in limb 2. The ratio of specific gravities of A to B is
    (A) 2   (B) 0.5   (C) 0.3   (D) 0.18

47. The velocity at the exit of the pipe as shown in the above figure will be

    (A) 9.9 m/s

    (B) 14.0 m/s

    (C) 17.1 m/s

    (D) 19.8 m/s
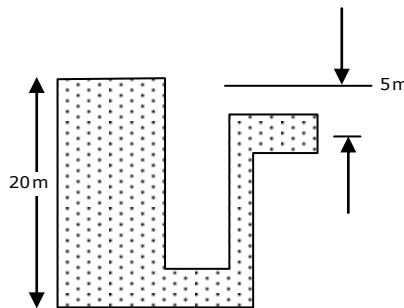
48. The centre of pressure of a plane submerged surface
    (a) is a point on the submerged area at which the resultant hydrostatic force is supposed to act?
    (b) should always coincide within the centre of submerged area
    (c) should be at the centre of gravity of the plane surface
    (d) is always below the centroid of area

49. A piece of metal of specific gravity 7 floats in mercury of specific gravity 13.6, what fraction of its volume is under mercury?
    (A) 0.5   (B) 0.4
    (C) 0.515   (D) Fully immersed

50. The streamline equation passing through the point (2,3) will be (The two dimensional flow is given by u = a and v = a)
    (A) x + y = 1   (B) y = x + 1   (C) 2x + y = 1   (D) None

51. A right circular cylinder, open at the top, is filled with a liquid of specific gravity 1.2, and rotated about its vertical axis at such a speed that half of the liquid spills out. The pressure at the centre of the bottom is
    (A) Zero
    (B) one-fourth its value when the cylinder was full
    (C) one-third its value when the cylinder was full
    (D) three-fourth its value when the cylinder was full

52. Consider the following statements about velocity potential:
    1. Velocity potential is a vector function similar to stream function
    2. It is a fully three dimensional function and not limited to two coordinates.
    3. Velocity potential does not exist at stagnation points
    4. Velocity potential exists only if the flow is irrotational
    Which of the statements are correct?
    (A) 1, 2 and 3   (B) 1, 2 and 4   (C) 1, 3 and 4   (D) 2, 3 and 4

53. The velocity potential function in a two dimensional flow field is given by $\theta = x^2 - y^2$. The magnitude of velocity at point P (1, 1) is
    (A) Zero   (B) 2   (C) $2\sqrt{2}$ (D) 8

54. A tube is used (as shown in the above figure) as a siphon to discharge an oil of specific gravity 0.8 from a large open vessel into a drain at atmospheric pressure. The velocity of oil through the siphon will be
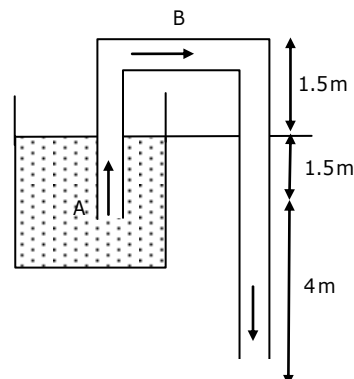
    (A) 1.5 m/s

    (B) 6.7 m/s

    (C) 8.8 m/s

    (D) 10.4 m/s

55. Water flows through a vertical contraction from a pipe of diameter d to another of diameter of $\frac{d}{2}$. Inlet velocity at inlet to contraction is 2 m/s and pressure 200 kN/m^2. If height of contraction measures 2m, the pressure at exit of contraction will be nearly to

(A) 192 kN/m^2 (B) 150 kN/m^2 (C) 165 kN/m^2 (D) 175 kN/m^2

56. In flow through a pipe, the transition from laminar to turbulent flow does not depend on

(A) density of fluid   (B) length of pipe
(C) diameter of pipe   (D) velocity of the fluid

57. A 0.20 m diameter pipe 20 km long transports oil at a flow rate of 0.01m^3/s. Calculate power required to maintain flow if dynamic viscosity and density of oil is 0.08 Pas and 900 kg/m^3 respectively.

(A) 4.064 kW   (B) 3.074 kW   (C) 5.064 kW   (D) 4.074 kW

58. Pressure loss for laminar flow through pipeline is dependent

(A) Inversely on flow of velocity
(B) Directly on square of pipe radius
(C) Directly on length of pipe
(D) Inversely on viscosity of flowing Medium

59. Fanno line flow is a flow a constant area duct

(A) with friction and heat transfer but in the absence of work
(B) with friction and heat transfer accompanied by work
(C) with friction but in the absence of heat transfer or work
(D) without friction but accompanied by heat transfer and work

60. In an adiabatic flow with friction through a constant area duct, the following phenomenon's are predicted:

1. The flow downstream tends to be sonic irrespective of the Mach-number upstream.
2. In the case of initially supersonic flow, any increase in duct length beyond choked flow would make the exit flow subsonic
3. In the case of initially subsonic flow, increase in duct length will not change sonic flow at the exit.
4. The optimum pipe length for sonic outlet in supersonic flow is considerably longer than that of subsonic flow for the same flow rate.

Which of these are correct?

(A) 1, 2 3 and 4   (B) 1, 2 and 3 only
(C) 1, 3 and 4 only   (D) 2, 3 and 4 only

61. The value of an extensive property is essentially dependent on

(A) Mass of the system
(B) Interaction of the system with its surroundings
(C) Path followed by the system in going from one state to another
(D) Nature of boundaries, rigid or flexible

62. The expression $\int_1^2 pdv$ gives the measure of work during

(A) Non flow reversible process
(B) Steady flow reversible process
(C) Open system and any process
(D) Any system and any process

63. The displacement work done by a system is given by $\int pdv$. It is valid for

(A) any process
(B) a quasi-static process
(C) an isentropic process
(D) a non quasi-static process

64. If power developed by a turbine in a certain steam power plant is 1200kW. Heat supplied to boiler is 3360 kJ/kg. The heat rejected by the system to cooling water is 2520 kJ/kg, and feed pump work required to condensate back into boiler is 6kW, then the mass rate of flow through the cycle will be

(A) 1.421 kg/s   (B) 14.21 kg/s   (C) 0.1421 kg/s   (D) 0.01421 kg/s

65. An electric power plant produces 10MW of power consuming $90 \times 10^6 \, kJ / hour$ of fuel energy. The heat rejected by the power plant is

(A) 5 MW   (B) 10 MW   (C) 15 MW   (D) 20 MW

66. Which thermodynamics law predicts correctly, the degree of completion of chemical reaction?

(A) Zeroth law   (B) First law   (C) Second law   (D) Third law

67. In a cyclic heat engine operating between a source temperature of 600°C and sink temperature of 20°C, the least rate of heat rejection per kW net output of engine is

(A) 0.588kW   (B) 0.650 kW   (C) 0.505kW   (D) 0.460 kW

68. A Carnot engine rejects 50% of heat absorbed from a source to a sink at 27°C. What is the source temperature?

(A) 54°C   (B) 150°C   (C) 327°C   (D) 600°C

69. A non flow quasi-static (reversible) process occurs for which P=(-3V + 16) bar, where V is volume in m^3. What is work done when V changes from 2 to 6 m^3 ?

(A) $16 \times 10^5 J$ (B) $16.5 \times 10^5 J$ (C) $16 \times 10^3 J$ (D) $16.5 \times 10^2 J$

70. A refrigeration unit has a COP of 4 and extracts 10 kJ of heat from the cold reservoir. If this machine works as a heat pump, how much heat will it deliver to the environment?

(A) 2 kJ   (B) 2.5 kJ   (C) 12.5 kJ   (D) 25 kJ

71. When a hydrocarbon fuel burns in deficit air, Orsat analyzer will show the presence of following gases in the engine exhaust

(A) CO_2, N_2 and O_2

(B) CO, CO_2, N_2 and O_2

(C) CO, CO_2 and N_2

(D) CO_2, CO, N_2, O_2 and H_2O

72.   Joule's experiment states that for a cycle
(A) change of pressure is proportional   to temperature change
(B) change of volume is proportional to temperature change
(C) change of internal energy is proportional to temperature change
(D) sum of all heat transfers is proportional to sum of all work transfers

73.   An insulated container is divided into two compartments A and B by a thin diaphragm. While A contains a mass of gas at pressure P and temperature T, B is evacuated. The diaphragm is punctured and the gas in A rushes into B. The process is called
(A) Adiabatic   (B) Isentropic
(C) Constant internal energy   (D) Free expansion

74.   A gas is following through an insulated nozzle. If the inlet velocity of gas is negligible and there is an enthalpy drop of 45 kJ/kg, the velocity of gas leaving the nozzle is
(A) 100 m/s   (B) 200 m/s   (C) 300 m/s   (D) 350 m/s

75.   The entropy of universe tends to
(A) become zero
(B) remain constant
(C) be maximum
(D) attain a certain finite minimum value

76.   If the time taken by a system to execute a process through a finite gradient is infinitely large, the process
(A) becomes reversible   (B) is reversible
(C) becomes isothermal   (D) is adiabatic

77.   Which of the following process are irreversible?
1.   Heat transfer through a finite temperature difference
2.   Free expansion
3.   Transfer of electricity through a resistor
(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 and 3 only

78.   Which of the following process are thermodynamically irreversible?
1.   Gradual heating of water from a hot source
2.   Isothermal expansion in a Stirling cycle
3.   Mixing of two ideal gases at constant pressure
(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1and 3 only

79.   Consider a gas turbine supplied with gas at 1000 K and 5 bar to expand adiabatically to a 1 bar. The mean specific heat at constant pressure is 1.0425 kJ/kgK and constant volume is 0.7662 kJ/kgK. Calculate power developed in kW/kg of gas per second and exhaust gas temperature
(A) 462 kW/kg and 647 K   (B) 362 kW/kg and 653 K
(C) 462. KW/kg and 653 K   (D) 362 kW/kg and 647 K

80. It is very useful in predicting the properties of gases for which more precise data are not available, but their critical properties are known.
(A) Van der Waals' equation of state
(B) Breattie-Bridegeman equation of state
(C) Redich-Kwong equation of state
(D) Generalized compressibility chart

81. If a pure substance is below the triple point temperature, the solid on being heated will only
(A) solidify or freeze
(B) liquefy
(C) vaporize or sublimate
(D) have its temperature increased

82. A 70 kg person walks on snow with a total foot implint area of 500 cm^2. What pressure does he exert on snow?
(A) 0.5 kPa   (B) 12.5 kPa   (C) 13.73 KN/m^2 (D) 137.3 kN/m^2

83. A reversible engine has ideal thermal efficiency of 30%. When it is used as a refrigerating machine with all conditions unchanged, the coefficient of performance will be
(A) 3.33   (B) 3.00   (C) 2.33   (D) 1.33

84. **Statement (I)**   :   Steady flow means that the rates of flow of mass and energy through the control volume are constant.
    Statement (II)   :   At the steady state of a system, any thermodynamic property will have a fixed value at a particular location and will not alter with time.
(A) Both Statements (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
(C) Statement (I) is true but Statement (II) is false
(D) Statement (I) is false but Statement (II) is true

85. **Statement (I)**   :   There is entropy transfer both in heat transfer and work transfer.
    Statement (II)   :   Both heat and work is energy in transition
(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
(C) Statement (I) is true but Statement (II) is false
(D) Statement (I) is false but Statement (II) is true

86. **Statement (I)**   :   The 'Inequality of Clausius' provides the criterion of the reversibility of a cycle.
    Statement (II)   : $\oint \dfrac{dQ}{T} > 0,$ the cycle is irreversible and possible

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(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

87. **Statement (I)**   :   Though the composition of the working fluids change from air and fuel to combustion products in all internal combustion engines, the working cycle is still named as air standard cycle.

   Statement (II)   :   The composition of nitrogen in air and fuel mixture is high and does not undergo any chemical reaction in the combustion chamber.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

88. **Statement (I)**   :   The index of compression and the index of expansion are different in reciprocating compressors.

   Statement (II)   :   Reciprocating compressors are used to compress a large pressure ratio and low discharge.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

89. **Statement (I)**   :   A good CI engine fuel is a bad SI engine fuel and a good SI engine fuel is bad CI engine fuel.

   Statement (II)   :   A CI engine fuel require high self-ignition temperature and along delay period whereas a SI engine fuel requires low self-ignition temperature and short delay period.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

90. **Statement (I)**   :   Specific output of a SI engine is higher than the CI engine.

   Statement (II)   :   Its higher engine speed and ability to burn richer mixture result in increased energy conversion rate.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

91. **Statement (I)** : While designing the SI engine the designer tries to keep the compression ratio as high as possible.

Statement (II) : Whereas while designing the CI engine the designer tries to keep the compression ratio as low as possible.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

92. **Statement (I)** : DI diesel engines use multi hole nozzles for fuel injection.

Statement (II) : Single hole nozzles cause wall impingement and carbon deposits.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

93. **Statement(I)** : Fins are equally effective irrespective of whether they are on the hot-side or cold-side of the fluid.

Statement (II) : The temperature along the fins variable and hence the rate of heat transfer varies along the elements of fins.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

94. **Statement (I)** : Immersion chilling in tanks of slush ice is better than the slow cool air chilling for poultry products.

Statement (II) : Cool lair chilling of poultry products cause a moisture loss of 1 to 2 percent while immersion chilling can cause a moisture absorption of 4 to 15 per cent.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

95. **Statement (I)**   :   In a fluid, the rate of deformation is far more important than the total deformation itself.

   Statement (II)   :   A fluid continues to deform so long as the external forces are applied.

   (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

   (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

   (C) Statement (I) is true but Statement (II) is false

   (D) Statement (I) is false but Statement (II) is true

96. **Statement (I)**   :   Mass flow through the convergent nozzle is maximum when the exit Mach number is 1.

   Statement (II)   :   The divergent section is added to convergent nozzle to increase the exit Mach number and not to increase the mass flow rate.

   (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

   (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

   (C) Statement (I) is true but Statement (II) is false

   (D) Statement (I) is false but Statement (II) is true

97. **Statement (I)**   :   When a bluff body moves at supersonic speed in still air, an attached shock wave is produced at its nose causing the flow to be subsonic behind the shock plane.

   Statement (II)   :   A normal shock always transforms supersonic flow into subsonic flow causing increase in pressure, temperature and entropy.

   (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

   (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

   (C) Statement (I) is true but Statement (II) is false

   (D) Statement (I) is false but Statement (II) is true

98. **Statement (I)**   :   Cavitation occurs at the entrance of the turbine while it occurs at the exit of the pump.

   Statement (II)   :   In both the cases local pressure at these points falls below the vapour pressure of the flowing liquid.

   (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

   (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

   (C) Statement (I) is true but Statement (II) is false

   (D) Statement (I) is false but Statement (II) is true

99. **Statement (I)**   :   In an isentropic nozzle flow, discharge reaches a maximum value when the throat pressure reaches the critical value.

   Statement (II)   :   At the critical condition, throat Mach number remains at unity and the upstream side of throat is maintained low enough to give a continuous decrease of pressure and a continuous increase of velocity.

(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

100. For a heat engine working on an air standard Diesel cycle the efficiency will
    (A) increase as the fuel cut-off ratio is increased
    (B) not change as the fuel cut-off ratio is increased
    (C) Decrease as the fuel cut-off ratio is increased
    (D) change as the fuel cut-off ratio is increased

101. For a given compression ratio, which of the following ideal cycles have equal thermal efficiency?
    (A) Diesel and Stirling   (B) Stirling and Otto
    (C) Otto and Joule   (D) Joule and Diesel

102. In gas cycle refrigeration, an engine is used instead of a throttle valve for pressure drop of the refrigerant, because
    (A) Enough cooling or temperature drop is not obtained by throttling
    (B) There can be even heating of the gas if the temperature before throttling is not below the maximum inversion temperature
    (C) There is inadequate content of temperature
    (D) There can be leakage of gas.

103. An air standard Otto cycle has volumetric compression ratio of 6, the lowest cycle pressure of 0.1 MPa and operates between temperature of 0.1 MPa and operates between temperature limit of 27°C and 1569°C. What is the temperature after isentropic expansion if ratio of specific heats is 1.4?
    (A) 600 K   (B) 700 K   (C) 900 K   (D) 1000 K

104. In SI engines for higher thermal efficiency
    (A) Compression ratio should be high
    (B) Heat liberation during combustion should be maximum
    (C) Surface to volume ratio should be high
    (D) Long flame travel distance

105. The object of providing masked inlet valve in the air passage of compression ignition engines is to
    (A) enhance flow rate   (B) control air flow
    (C) induce primary swirl   (D) induce secondary turbulence

106. Which one of the following types of swirls is generated by a precombustion chamber is the diesel engine?
    (A) Squish   (B) Compression swirl
    (D) Induction swirl   (D) Combustion induced swirl

107. In an SI engine the first state of combustion takes 1 ms at 1000 rpm of the engine. The spark timing is set at 15°C btdc. What will be the new spark timing required if the engine speed is doubled?
(A) 15°C btdc   (B) 21°C btdc   (C) 27°C btdc   (D) 39°C btdc

108. Increase in the compression ratio in Otto cycle may cause
(A) Misfiring   (B) detonation
(C) Knocking   (D) longer ignition delay

109. Which of the following increase the diesel knocking tendency?
1. Decreased compression ratio
2. Decreased engine speed
3. Retarded injection timing
4. Supercharging
(A) 1 only   (B) 2 only   (C) 2 and 3   (D) 3 and 4

110. Pre-ignition in SI engines results in:
1. Increase in the work of compression
2. Increase in the network of the process cycles
3. Decrease in fuel efficiencies
4. Decrease in fuel loss from the engine
(A) 1, 2 and 3   (B) 1, 3 and 4   (C) 1 and 3 only   (D) 2 and 4 only

111. Which of the following statements are correct for "Diesel knock"?
1. A long ignition delay period increases tendency of Diesel knock
2. The Diesel knock occurs near the end of combustion
3. The rate of pressure rise in Diesel knock is lower than in detonation in spark ignition engines.
(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 and 3 only

112. Which of the following remarks pertaining to supercharging of IC engines are correct?
1. Ideal supercharging increases the output, but decreases the thermal efficiency slightly
2. The indicated mean effective pressure and mechanical efficiency increase with supercharging
3. The permissible amount of supercharging depends on the compression ratio, air-fuel mixture and design of engine
4. Engine friction losses increase with supercharging
(A) 1, 2,3 and 4   (B) 1, 2 and 3 only
(C) 1, 2 and 4 only   (D) 2, 3 and 4 only

113. Which of the following statements are correct for turbo-prop powered aircrafts ?
1. The propulsion efficiency of turboprop is higher than that of turbo-jet and rockets for low speeds up to about 800 km/hr.
2. For the same thrust the turbine in the turbo-prop aircraft is smaller than in the turbo-jet aircraft
3. For the turbo-prop the flight velocity cannot exceed the jet velocity.
(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 and 3 only

114. If absolute jet exit velocity from a jet engine if 2800 m/s and forward flight velocity is 1400 m/s, then propulsive efficiency is
     (A) 33.33%   (B) 40%   (C) 66.66%   (D) 90%

115. An air-breathing aircraft is flying at an altitude where the air density is half the value at ground level. With reference to the ground level, the air fuel ratio at this altitude will be
     (A) ½   (B) 1   (C) 2   (D) 4

116. Which of the following statements are correct for rockets?
     1. Unlike the turbo-jet aircraft, in rockets the flight velocity can exceed the jet velocity
     2. In rockets gases having lower molecular weight increase the specific thrust
     3. In rockets the gases are expanded in the nozzle up to the atmosphere pressure.
     (A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 and 3 only

117. The purpose of a thermostat in an engine cooling system is to
     (A) prevent the coolant from boiling
     (B) allows the engine to warm up quickly
     (C) pressurize the system to raise the boiling point
     (D) indicate to the driver, the coolant temperature

118. When water emulsion is used as the fuel in SI engine the emission of nitrogen oxides reduces significantly, this is due to
     (A) water reacts with nitrogen oxides
     (B) water does not contain nitrogen
     (C) the combustion temperature decreased
     (D) the combustion temperature increased

119. In spark ignition petrol engines maximum emission of NO_x takes place when the air fuel ratio (A/F) is
     (A) very weak mixture and A/F ratio about 19
     (B) weak mixture and A/F ratio about 17
     (C) chemically correct mixture and A/F ratio about 15
     (D) rich mixture and A/F ratio about 13.

120. In an experiment to determine the higher calorific value of a fuel with bomb calorimeter, a few drops of water is dropped into the bomb before sealing. This is to
     (A) help absorption of carbon dioxide gas
     (B) absorb latent heat of stream formed by combustion of hydrogen
     (C) saturate the air inside with water vapour initially
     (D) avoid overheating of the contents by burnt gases