UPPSC AE ME 2013 (Paper-II)

1. Water at 42ºC is sprayed into a steam of air at atmospheric pressure, dry bulb temperature of 40ºC and a wet bulb temperature of 20ºC. the air leaving the spray humidifier is not saturated. which of the following statements is true?
   A. Air gets cooled and humidified
   B. Air gets heated and humidified
   C. Air gets heated and dehumidified
   D. Air gets cooled and dehumidified

2. In an ideal vapour compression refrigeration cycle, the specific enthalpy of refrigerant (kJ/kg) at the following stages is given as
   Inlet of condenser = 283
   Outlet of condenser = 116
   Exit of evaporator = 232
   The COP is
   A. 2.27
   B. 2.75
   C. 3.27
   D. 3.75

3. Duration the chemical dehumidification process of air
   A. Dry bulb temperature and specific humidity decrease
   B. Dry bulb temperature increase and specific humidity decrease
   C. Dry bulb temperature decreases and specific humidity increases
   D. Dry bulb temperature and specific humidity increases

4. Dew point temperature is the temperature at which condensation begins when the air is cooled at constant
   A. volume
   B. entropy
   C. pressure
   D. enthalpy

5. For air with a relative humidity of 80%
   A. the dry bulb temperature is less than the wet bulb temperature
   B. the dew point temperature is less than the wet bulb temperature
   C. the dew point and wet bulb temperature are equal
   D. the dry bulb and dew point temperature are equal

6. In window air-conditioner the expansion device used is
   A. capillary tube
   B. thermostatic expansion valve
   C. automatic expansion valve
   D. float valve

7. One ton of refrigeration is equivalent to SI unit of
   A. 1 kW
   B. 2.5 kW
   C. 3.5 kW
   D. 5 kW

8. Efficiency of a Carnot engine is 75%. If the cycle direction is reversed, CoP of the reversed Carnot cycle is
   A. 1.33
   B. 0.75
   C. 0.33
   D. 1.75

9. As an index of comfort, the temperature of saturated air at which a person would experience the same feeling of Comfort as experience in the actual unsaturated environmental is called
   A. Comfort temperature
   B. Effective temperature
   C. Wet bulb temperature
   D. Soothing temperature

10. If the specific humidity of moist air remains the same but its DBT increases, its DPT
   A. remain the same
   B. increases
   C. decreases
   D. may increase or decrease depending on its relative humidity

11. In a vapour compression cycle, a good refrigerator should have a
   A. large latent heat of vaporization at condenser pressure
   B. large latent heat at evaporator pressure
   C. condenser pressure close to critical pressure
   D. low critical pressure.

12. R-12 is preferred over R-22 in deep freezer, because

A. it has lower operating pressure

B. it gives higher CoP

C. it is miscible with oil over a large range of temperature

D. All of the above.

13. Low grade fuels have

A. low moisture content

B. low ash content

C. low calorific value

D. high carbon content

14. Which of the following does not use ambient air for propulsion?

A. Turbo jet

B. Pulse jet

C. Turbo-prop

D. Rocket

15. Humidity ratio can be given in terms of partial pressures of dry air (P_a) and water vapour (P_V) as

A. $0.622\left(\frac{P_a}{P_v}\right)$

B. $0.622\left(\frac{P_V}{P_A}\right)$

C. $0.622\left(\frac{P_V}{P_v - P_a}\right)$

D. None of the above

16. If the air is passed over the cooling coils then this process is termed as

A. sensible heating

B. cooling with humidification

C. cooling with dehumidification

D. None of the above

17. COP of air refrigerator is related with COP of vapour compression refrigerator as

A. $(COP)_{air} > (COP)_{vap.c.}$

B. $(COP)_{air} < (COP)_{vap.c.}$

C. $(COP)_{air} = (COP)_{vap.c.}$

D. None of the above

18. In an air craft refrigeration system the pressure at the cooling turbine outlet is equal to

A. ambient pressure

B. cabin pressure

C. pressure at inlet to compressor

D. None of the above

19. The relative humidity, during sensible heating

A. can increase or decrease

B. increases

C. decreases

D. remains constant

20. Kelvin Planck law deals with

A. conversion of work into heat

B. conversion of heat into work

C. conservation of work

D. conservation of heat

21. Thermodynamic work is the product of

A. Two intensive properties

B. Two extensive properties

C. An intensive property and change in an extensive property

D. An extensive property and change in an intensive property

22. Air is compressed adiabatically in a steady flow process with negligible change in potential and kinetic energy. The work done in the process in given by

A. $-\int pdv$

B. $+\int pdv$

C. $-\int vdp$

D. $+\int vdp$

23. A heat engine is supplied with 250 kJ/s of heat at constant fluid temperature of 227°C. The heat is rejected at 27°C. The cycle is reversible, if the amount of heat rejected is

A. 273 kJ/s

B. 200 kJ/s

C. 180 kJ/s

D. 150 kJ/s

24. The sequence of processes that eventually returns the working substance to its original state is known as

A. Event

B. Process

C. Thermodynamic property

D. Thermodynamic cycle

25. If the dryness fraction of a sample by throttling calorimeter is 0.8 and that by separating calorimeter is also 0.8, then the actual dryness fraction of sample will be taken as

A. 0.8

B. $\sqrt{0.8}$

C. 0.64

D. 0.5

26. Thermodynamic equilibrium is completely defined by the specifications of

A. Internal energy

B. Enthalpy

C. Generalized displacements

D. All of the above

27. Gas expands for a definite volume in a closed vessel. The maximum work will be done when the process is at constant

A. Volume

B. Temperature

C. pressure

D. Enthalpy

28. Which conversion is incorrect?

A. 1 kWh = 3.6×10^6 Nm

B. 1 Nm = 0.238×10^3 kcal

A. 1 HP hr = 0.746 kWh

A. 1 kcal = 4.1868 Nm

29. In an air standard Diesel cycle at fixed compression ratio and fixed value of adiabatic index (γ)

A. thermal efficiency increases with increase in heat addition cut-off ratio

B. thermal efficiency decreases with increase in heat addition cut-off ratio

C. thermal efficiency remains same with increase in heat addition cut-off ratio

D. None of the above

30. In Rankine cycle, the work output from the turbine is given by

A. change In internal energy between. inlet and outlet.

B. change in enthalpy between inlet and outlet.

C. change in entropy between inlet and outlet.

D. change of temperature between inlet and outlet.

31. For a closed system, undergoing an expansion process according to the law PV^n = constant, the work output.
    A. increases with increase in 'n'
    B. increases with decrease in 'n'
    C. is maximum when n = 0
    D. is independent of 'n'

32. Law of degradation of energy says that unavailable energy is gradually decreasing due to
    A. increase in reversible processes
    B. increase in irreversible processes
    C. increase in unavailable energy
    D. None of these

33. For the same compression ratio, the efficiency of Brayton cycle is
    A. equal to that of Diesel cycle
    B. equal to that of Otto cycle
    C. equal to that of Dual cycle
    D. greater than that of Diesel cycle

34. If the temperature at the turbine inlet is kept constant, the net output of a simple gas turbine plant would
    A. increase with increasing pressure ratio.
    B. decrease with increasing pressure ratio.
    C. first increase and then decrease with increasing pressure ratio.
    D. remains unaffected with changes in pressure ratio.

35. When the relationship between Reynolds number and the friction factor is represented by a straight line, the flow is said to be
    A. isentropic
    B. laminar
    C. turbulent
    D. vortex

36. At the point of separation
    A. velocity is maximum
    B. shear stress is zero
    C. shear stress is maximum
    D. Pressure gradient is zero

37. A potential function exists for

A. steady flow only
B. two dimensional irrotational flow only
C. irrotational flow of fluid whether compressible or incompressible
D. irrotational flow of incompressible fluids only

38. Which property of mercury is the main reason for use in barometers?
A. High density
B. Negligible capillary effect
C. Very low vapour pressure
D. Low compressibility

39. In case of fluid flow through cavitation is caused by
A. high pressure
B. High velocity
C. low pressure below a limit
D. weak material of pipe

40. A stream function
A. is a mathematical function which has no physical equivalence
B. is defined only for steady and incompressible flow
C. satisfies Laplace equation for rotational motion
D. may not remain constant for a streamline

41. For the flow to occur between two points in a pipeline, the differential pressure between these point should be more than
A. surface friction
B. viscosity force
C. frictional force
D. All of the above

42. Fluid is flowing in a curved path without any external impressed contact force. This flow is known as
A. free vortex flow
B. forced vortex flow
C. radial flow
D. spiral flow

43. In fluid flow through pipes, transition from laminar to turbulent flow, does not depend on
A. length of pipe
B. density of fluid
C. diameter of pipe

D. velocity of flow

44. In the region of boundary layer on a flat plate surface where velocity is not zero, the viscous force is
A. less than inertial force
B. more than inertial force
C. equal in magnitude
D. not predictable

45. The magnitude of water hammer in the flow of a liquid through a pipe does not depend upon
A. length of pipe
B. elastic properties of pipe material
C. temperature of liquid
D. time of valve closure

46. Compressibility effect can be treated as negligible when Mach number is
A. upto 0.2
B. upto 0.5
C. less than
D. 1

47. A body is called streamline body when
A. it is symmetrical about the axis along the free stream
B. surface of the body coincides with the streamlines
C. flow is laminar around it
D. it produces no drag for flow around it

48. Mach number is the ratio of
A. elastic force to gravity force
B. viscous force to elastic force
C. inertial force to surface tension
D. inertial force to elastic force

49. For a linear distribution of velocity in the boundary layer on a flat plate, the ratio of displacement thickness to nominal thickness is
A. 1/4
B. 1/3
C. 1/2
D. 2/3

50. In case of laminar flow through pipe, the ratio of total kinetic energy of fluid passing per second to the energy value obtained on the basis of average velocity is
A. 1.2
B. 1.54
C. 2.0
D. 2.37

51. Sonic velocity will have a low value in the medium having
A. low value of compressibility
B. High value of compressibility
C. High bulk modulus of elasticity
D. Homogeneous composition.

52. An isentropic flow is one which is
A. adiabatic and reversible
B. isothermal only
C. adiabatic only
D. adiabatic and irreversible

53. The size of a venturimeter is specified by
A. fluid pressure
B. discharge
C. pipe diameter and throat diameter
D. length of venturimeter

54. In a flow field at the stagnation point
A. pressure is zero
B. total energy is zero
C. pressure head is equal to velocity head
D. All the velocity head is converted into pressure head

55. Which two forces are most important in laminar flow between parallel plates?
A. Inertial and viscous
B. Viscous and pressure
C. Gravity and pressure
D. Pressure and inertial

56. A high value of thermal diffusivity represents
A. high storage, less conduction of heat
B. less storage, more conduction of heat
C. There is always equal amount of conduction and storage since it is a property

D. It has no relevance

57. What happens when the thickness of insulation on a pipe exceeds the critical value?
A. Heat transfer rate increases
B. Heat transfer rate decreases
C. Heat transfer rate remains constant
D. None of these

58. For flow of fluid over a heated plate, the following fluid properties are known :
Viscosity = 0.001 Pa.s, sp. heat at constant pressure = 1 kJ/kg-K, thermal conductivity = 1W/mK.
The hydrodynamic boundary layer thickness at a specified location on the plate if 1 mm, the thermal boundary layer thickness at the same location is
A. 0.001 mm
B. 0.01 mm
C. 1 mm
D. 10 mm

59. Which one of the following configuration has the highest fin effectiveness?
A. think, close spaced
B. thin, widely spaced
C. thick, widely spaced
D. thick, close spaced

60. In a condenser of a power plant, the steam condenses at a temperature of 60°C. The cooling water enters at 30°C and leaves at 45°C. Logarithmic Mean Temperature Difference (LMTD) of the condenser is
A. 16.2°C
B. 21.6°C
C. 30°C
D. 37.5°C

61. In a heat exchanger, the temperature of the hot fluid decreases while the temperature of the cold fluid increases. The increase and decrease following:
A. A quadratic law
B. A linear law
C. A cubic law
D. An exponential law

62. Which substance has the minimum value of thermal conductivity?

A. Air

B. Water

C. Plastic

D. Rubber

63. Lumped parameter analysis for transient heat conduction is essentially valid of

A. $B_i < 0.1$

B. $0.1 < B_i < 0.5$

C. $1 < B_i < 10$

D. $B_i \rightarrow \infty$

64. Cork is a gold thermal insulator because

A. Its density is low

B. It is porous

C. It can be powdered

D. It is flexible.

65. Unsteady state of heat flow occurs in

A. Flow of heat through furnace walls

B. Flow of heat through insulated pipe with constant surface temperature

C. Annealing of castings

D. Flow of heat through refrigerator walls

66. The temperature inside a furnace is generally measured by

A. Mercury thermometer

B. Alcohol thermometer

C. Gas thermometer

D. Optical pyrometer

67. Heat is transferred by conduction, convection and radiation in

A. Insulated pipes carrying hot water

B. Refrigerator freezer coils

C. Melting of ice

D. Boiler furnaces

68. The density of water is maximum at

A. 20°C

B. 4°C

C. 0°C

D. – 4°C

69. Which non-metallic body is expected to have highest value of emissivity?
A. Iron oxide
B. Carbon
C. Ice
D. Paper

70. The rate of heat transfer by conduction in pipes at critical radius is
A. equal to the rate of heat transfer by convection and is maximum
B. equal to the rate of heat transfer by convection and is minimum
C. greater than the rate of heat transfer by convection
D. less than the rate of heat transfer by convection

71. The heat transfer coefficient over the surface of a pin fin decreases, then
A. its effectiveness will decrease.
B. its effectiveness will increase.
C. its effectiveness will remain unchanged
D. its effectiveness will first increase and then decrease

72. The critical radius of insulation for a sphere is equal to
A. 2 kh
B. h/2k
C. 2k/h
D. $\sqrt{2kh}$
Where symbols have usual meanings.

73. In a cylinder under steady state conduction with uniform heat generation, the temperature gradient at half the radius location will be
A. one half of that at surface
B. one fourth of that at surface
C. twice that at surface
D. four times that at surface

74. For the quick response of a thermocouple
A. its wire diameter should be large
B. the convective heat transfer coefficient should be high
C. the specific heat should be high
D. the density should not be very small

75. If Nusselt number is 390, Reynolds number is 39 and Prandtl number is 20, then Stanton number will be
A. 780

B. 200

C. 2

D. 0.5

76. The temperature of a solid surface is raised from 227°C to 727°C. The emissive power of the body will change from E_1 to E_2 such that E_2/E_1

A. 400

B. 16

C. 4000

D. 1600

77. For an opaque body sum of absorptivity and reflectivity is

A. 0

B. 1.0

C. less than 1.0

D. greater than 1.0

78. Efficiency of a Diesel cycle will approach to Otto cycle when

A. diesel engine will operate at high speed

B. cut-off period of diesel cycle is reduced to zero

C. diesel fuel is balanced with petrol

D. None of these

79. A gas turbine cycle with heat exchanger and reheating improves

A. only the thermal efficiency

B. only the specific power output

C. both thermal efficiency and specific power output

D. neither thermal efficiency nor specific power output

80. The ideal efficiency of simple gas turbine cycle depends upon

A. pressure ratio

B. cut-off ratio

C. both (A) and (B)

D. None of the above

81. The area of a p-v diagram for a Carnot cycle represents

A. heat supplied

B. heat rejected

C. work done

D. temperature drop

82. For a given set of operating pressure limits of a Rankine cycle the highest efficiency occurs

A. Saturated cycle

B. Superheated cycle

C. Reheat cycle

D. Regenerative cycle

83. Which process is responsible production of energy in the Sun?

A. Nuclear fission reaction

B. Nuclear fusion reaction

C. Exothermal chemical reaction

D. All of the above

84. Terrestrial radiation has a wavelength in the range of

A. 0.2 μm to 4 μm

B. 0.2 μm to 0.5 μm

C. 0.380 μm to 0.760 μm

D. 0.29 μm to 2.3 μm

85. A solar thermal collector

A. collects the solar energy and reflects it back.

B. absorbs the solar radiation and dissipates it to the ambient

C. collects and converts the solar energy into electrical energy

D. collects and converts the solar energy into thermal energy and delivers it to the next stage of the system.

86. A solar cell is basically

A. voltage source, controlled by flux of radiation.

B. a current source, controlled by flux of radiation.

C. an uncontrolled current source

D. an uncontrolled voltage source

87. The working fluid used in an MHD system coupled to a fast breeder reactor is

A. hot flue gases

B. seeded inert gas

C. liquid metal inert gas

D. liquid metal only

88. For the same maximum pressure and temperature

A. Otto cycle is more efficient than diesel cycle

B. Diesel cycle is more efficient than Otto cycle

C. Dual cycle is more efficient than Otto and Diesel cycle

D. Dual cycle is less efficient than Otto and Diesel cycle

89. Consider the following emissions of an I.C. engine.

1. CO_2
2. HC
3. NO_x
4. Particulate

Which of these emissions causes photochemical smog?

A. 1 and 4

B. 1 and 2

C. 2 and 3

D. 3 and 4

90. Consider the following statements:

Knock in the S.I. engine can be reduced by

1. Supercharging
2. Retarding the spark
3. Using a fuel of long straight chain structure.
4. Increasing the engine speed.

Of these correct statements are

A. 1 and 2

B. 2 and 3

C. 1, 3 and 4

D. 2 and 4

91. Which of the following is considered to be superior quality coal for power plants.?

A. Bituminous coal

B. Peat

C. Coke

D. Lignite

92. A curve showing the variation of load on a power station with respect to time is known as

A. Load curve

B. Load duration curve

C. Diversity factor

D. Performance curve

93. The capacity of generators being installed in super thermal power plant is

A. 100 MW

B. 400 MW

C. 200 MW

D. 500 MW

94. Fuel injection pressure in solid injection system is approximately in the range of

A. < 10.5 bar

B. 10.5 — 21 bar

C. 30 — 50 bar

D. 200 — 246 bar

95. The thermal efficiency of a gas turbine cycle with ideal regenerative heat exchanger is

A. equal to work ratio

B. less than work ratio

C. more than work ratio

D. unpredictable

96. The ratio of work done to the energy supplied to rotor in a turbine stage is called

A. blade efficiency

B. stage efficiency

C. nozzle efficiency

D. None of these

97. The diagram efficiency is highest for simple impulse turbine stage having smooth and symmetrical blade when blade steam speed ratio can be given as

A. $\cos \alpha_1$

B. $\cos \alpha_1/4$

C. $\cos \alpha_1/2$

D. None of these

Where α_1 is the angle of absolute velocity at inlet.

98. What will happen to the volumetric efficiency with increasing pressure ratio in case of single stage compression in compressions?

A. Decreases

B. Increases

C. Remains unaffected

D. None of these

99. The compression work requirement is minimum in case of compression process being

A. Adiabatic

B. Isochoric

C. Isothermal

D. Hyperbolic

100. If a mass of moist air in an air tight vessel is heated to a higher temperature, then

A. specific humidity of the air Increases

B. specific humidity deceases

C. relative humidity increases

D. relative humidity decreases