1. A football was inflated to a gauge pressure of 1 bar when the ambient temperature was 15°C. When the game started next day, the air temperature at the stadium was 5°C. Assume that the volume of the football remains constant at 2500 cm3. Gauge pressure of air to which the ball must have been originally inflated so that it would equal 1 bar gauge at the stadium is _____.
   A. 2.23 bar B. 1.94 bar
   C. 1.07 bar D. 1 bar

Ans. C

Sol: PV = mRT
P2 = Patm + Pg
= 1.013 + 1
= 2.013bar
Constant volume prosses
P1/T1 = P2/T2
P1/288 = 2.013/278
P1 = 2.085bar
Gauge pressure is 2.0854 – 1.013 = 1.07bar

2. The engine oil at 150°C is cooled to 80°C in a parallel flow heat exchanger by water entering at 25°C and leaving at 60°C. The exchanger effectiveness will be _____.
   A. 0.36 B. 0.46
   C. 0.56 D. 0.66

Ans. C

Sol: for oil
Effectiveness is given by
$\epsilon = \frac{h_1 - h_2}{h_1 - c_2} = \frac{150-80}{150-25} = 0.56$
for water
Effectiveness is given by
$\epsilon = \frac{c_2 - c_1}{h_1 - c_1} = \frac{60-25}{150-25} = 0.28$
According to option answer is 0.56

3. The atomic packing factor is the highest in which of the following cubic lattice system?
   A. Simple Cubic
   B. Body Centered Cubic (BCC)
   C. Face Centered Cubic (FCC)
   D. Diamond Cubic

Ans. C

Sol: packing factor
Simple Cubic→0.52
Body Centered Cubic (BCC)→0.68
Face Centered Cubic (FCC)→0.74
Diamond Cubic→0.34

4. The valves mounted on the boilers which change the direction of flow of steam by 90° and valves fitted in the pipelines which allow the steam in the same direction are respectively called as _____.
   A. Stop valves and junction valves
   B. Junction valves and stop valves
   C. Junction valves and safety valves
   D. Feed safety valves and stop valves

Ans. B

Sol: Junction valves

stop valves

5. Which of the following are boiler mountings and not boiler accessories?
   A. Pressure gauge
   B. Air preheater
   C. Superheater
   A. B and C only B. A only
   C. A, B and C D. A and C only

Ans. B

Sol: →categories include the fittings which are primarily indicated for the safety of the boiler and for complete control the process of steam generation. These units are called mountings. The mounting from an integral part of the boiler and are mounted on the body of the boiler itself.
→ categories include the components which are installed to increase the efficiency of the steam power plants and help in the power working of the boiler unit. These fitting are called boiler accessories.

6. Entropy is a measure of _____.
   A. Reversible heat transfer
   B. System efficiency
   C. Degree of randomness
   D. System temperature

Ans. C

Sol: Entropy, the measure of a system's thermal energy per unit temperature that is unavailable for doing useful work. Because work is obtained from ordered molecular motion, the amount of entropy is also a measure of the molecular disorder, or randomness, of a system.

7. Gibbs free energy is considered at which one of the following condition?
   A. Isothermal, isochoric
   B. Isobaric, isochoric
   C. Isothermal, isobaric
   D. None of these

Ans. C

Sol: Gibbs free energy is used to calculate the maximum of reversible work that may be performed by a thermodynamic system at constant temperature (isothermal) and constant pressure (isobaric)

8. In vapour absorption refrigeration systems, which of the following fluids are commonly used?
   A. air and water
   B. sulphur dioxide and water
   C. ammonia and water
   D. Freon and water

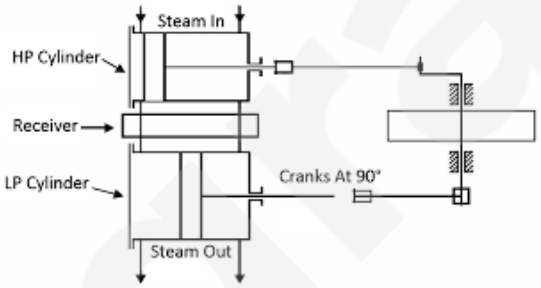
Ans. C

Sol: The vapor absorption refrigeration system comprises of all the processes in the vapor compression refrigeration system like compression, condensation, expansion and evaporation. In the vapor absorption system the refrigerant used is ammonia, water or lithium bromide. The refrigerant gets condensed in the condenser and it gets evaporated in the evaporator. The refrigerant produces cooling effect in the evaporator and releases the heat to the atmosphere via the condenser.

9. In a cross compound steam engine _____.
   A. one high and one low pressure cylinder are set side by side, driving the same shaft, cranks being set 90° apart
   B. two cylinders are centred on the same piston rod, the 1.p. cylinder being placed nearest the crankshaft
   C. two cylinders are set at 90°, usually to save floor space
   D. None of these

Ans. B/A

Sol:



Above Figure is Cross Compound Steam Engine which have one HP Cylinder and another one LP Cylinder but crank being at 90^0

10. Which of the following is expected to have highest thermal conductivity?
   A. steam B. solid ice
   C. melting ice D. water

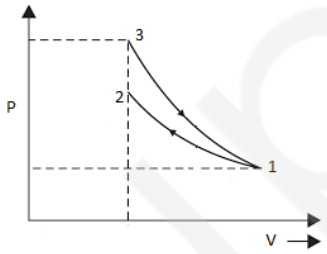
Ans. B

Sol: solid ice → 3.48 W/mK
Water →2.18 W/mK
Thermal conductivity of most solids is greater than that of liquids.

11. A reversible thermodynamic cycle containing only three processes and producing work is to be constructed. The constraints are
   A. there must be one isothermal process
   B. there must be one isentropic process
   C. maximum and minimum cycle pressures and the clearance volume are fixed, and
   D. polytropic processes are not followed then, the number of possible cycles is
   A. 1 B. 2
   C. 3 D. 4

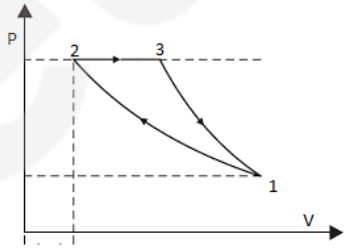
Ans. A/B

Sol: first possible cycle



3-1 Isentropic 2-3 Isochoric 1-2 Isothermal

Second possible cycle

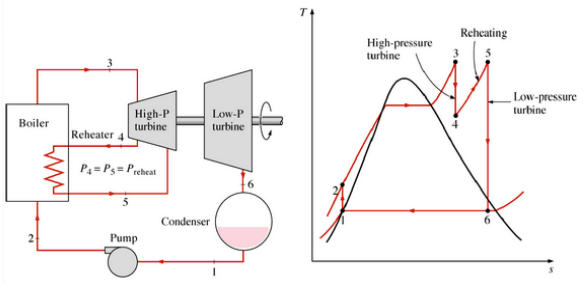


3-1 Isentropic 1-2 Isothermal 2-3 Isobaric

12. Which combination of the following statements if correct?
   The incorporation of re-heater in a steam power plant
   A. Always increase the thermal efficiency of the plant
   B. Always increases the dryness fraction of steam at condenser inlet
   C. Always increases the main temperature of heat addition
   D. Always increases the specific work output
   A. A and D only B. B and D only
   C. A, C and D only D. A, B, C and D

Ans. D/B

Sol: dry fraction and turbine output will always increase as it can be easily deduced from the diagram.



Efficiency might not always increase as it depends upon the mean temperature of heat addition which it self may not increase always.
Or, Efficiency = work output/heat supplied,
If heat supplied is less than only efficiency increase.

13. The amount of heat required to raise the temperature of 1 kg of water from 0°C to the saturation temperature Ts°C at a given constant pressure is defined as _____.
A. superheat B. Entropy
C. Latent heat D. Sensible heat

Ans. D

Sol: saturation temperature corresponding to any pressure is defined as a temperature at which liquid starts vaporizing. For normal atmospheric pressure saturation temperature is boiling temperature.

14. The enthalpy of steam is defined as _____.
A. Difference of internal energy and product of pressure and volume.
B. Product of internal energy and pressure.
C. Sum of internal energy and product of pressure and volume.
D. Amount of heat change divided by the absolute temperature.

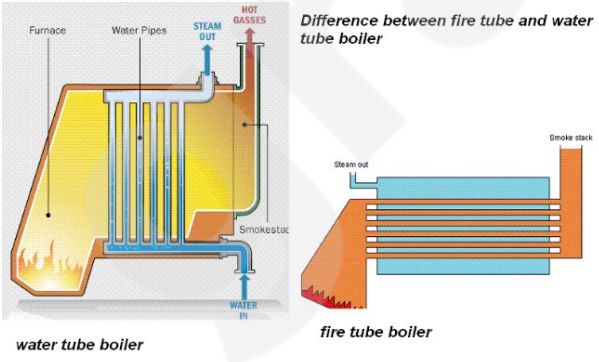
Ans. C

Sol: H = U + PV

15. What are the advantages of water tube boilers over fire tube boilers?
A. Steam at higher pressures can be produced.
B. More effective heat transfer
C. Sediment deposition is more
A. A only B. A and C only
C. A, B and C D. A and B only

Ans. D

Sol:



Fire tube boiler→

- In this boiler the hot flue gases is present inside the tubes and water surrounds them
- They are low pressure boilers. The operating pressure is about 25 bar.
- The overall efficiency of this boiler is upto 75%.

Water tube boiler→

- The water is present inside the tubes and the hot flue gases surrounds them
- They are high pressure boilers and the operating pressure is about 165 bar.
- The overall efficiency is upto 90% with the economizer.

16. What is the state, in which none of the properties of the system change with time, known as?
A. Unsteady state B. Steady state
C. Dynamic D. Quasistatic

Ans. B

Sol: The definition of a steady-state is an unchanging condition, system or physical process that remains the same even after transformation or change.

17. The rate of heat transfer across any plane normal to the x-direction is proportional to the wall area and the temperature gradient in the x-direction. This statement is also referred to as _____.
A. Second Law of Thermodynamics
B. Kelvin's Law
C. Third Law of Thermodynamics
D. Fourier's Law

Ans. D

Sol: $Q \propto A\frac{\partial T}{\partial X}$

18. The critical temperature of a pure substance is defined as _____
A. The minimum temperature at which solid and liquid phases can coexist in equilibrium.
B. The maximum temperature at which solid and liquid phases can coexist in equilibrium.
C. The minimum temperature at which vapour and liquid phases can coexist in equilibrium.
D. The maximum temperature at which vapour and liquid phases can coexist in equilibrium.

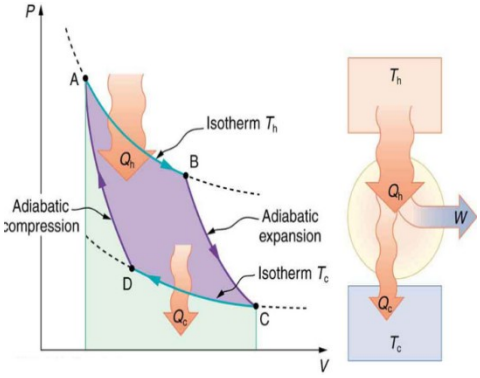
Ans. D

Sol: the temperature of a gas in its critical state, above which it cannot be liquefied by pressure alone.
374°C is the critical temperature of water, this is the maximum temperature till which vapor and liquid phase co-exist, beyond this only water vapor exists.

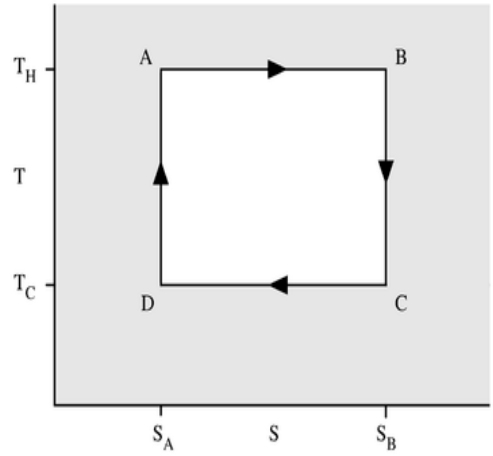
19. Which of the following is the correct expression for the maximum thermal efficiency (η) of a system undergoing a reversible power cycle while operating between thermal reservoirs at temperature Tc and Th
A. η = Tc/Th B. η = Th/Tc-1
C. η = 1-Tc/Th D. η = 1

Ans. C

Sol:



$$\eta = \frac{W_{output}}{Q_H} = \frac{Q_H - Q_C}{Q_H} = 1 - \frac{Q_C}{Q_H}$$



$Q_H = T_H(S_B - S_A)$
$Q_C = T_C(S_B - S_A)$
$Q_C/Q_H = T_C/T_H$
$\eta = 1 - TC/TH$

20. In actual refrigeration systems, the compressor handles vapour only. What is this process commonly referred to as _____.
A. Gas compression B. Phase compression
C. Dry compression D. Wet compression

Ans. C

Sol: Compression start from Dry saturated vapor condition and ends in the superheated region

21. Property of a fluid at zero temperature is referred to as _____.
A. Stagnation property
B. Standard property
C. Simple property
D. None of these

Ans. A

Sol: stagnation properties at a point are defined as those which are to be obtained if the local flow were imagined to cease to zero velocity.

22. The increase in pressure _____.
A. lowers the boiling point of a liquid
B. raises the boiling point of a liquid
C. does not affect the boiling point of a liquid
D. reduces its volume

Ans. B

Sol: liquid vaporis when molecules moves faster and far apart to each other but while increasing pressure, means applying an external force to hold molecules closer to each other. Hence, molecules will require more energy to overcome this resistance thus this increases boiling point of liquid

23. The overall efficiency of thermal power plant is _____.
A. Boiler efficiency, turbine efficiency and generator efficiency
B. Boiler efficiency, turbine efficiency, generator efficiency and gas cycle efficiency
C. Carnot cycle efficiency
D. Regenerative cycle efficiency

Ans. A

Sol: overall efficiency of steam power plant defined as the ratio of heat equivalent of electrical output to the heat of combustion. it is determined by product of the thermal efficiency and electrical efficiency.
Thermal efficiency is equal to product of turbine and boiler efficiency. Electrical efficiency is equal to generator efficiency.

24. Heat transfer by radiation mainly depends upon _____.
A. its temperature
B. nature of the body
C. kind and extent of its surface
D. All options are correct

Ans. D

Sol: $q = \varepsilon \sigma T^4 A$
q = heat transfer
σ = 5.6703 10-8 (W/m2K4) - The Stefan-Boltzmann Constant
T = absolute temperature in Kelvin (K)
A = area of the emitting body (m2)
ε = emissivity

25. Thermal diffusivity is _____.
A. a dimensionless parameter
B. function of temperature
C. used as mathematical model
D. a physical property of the material

Ans. D

Sol: thermal diffusivity is the thermal conductivity divided by density and specific heat capacity at constant pressure. It measures the rate of transfer of heat of a material from the hot side to the cold side.

26. Condensing temperature in a refrigerator is the temperature _____.
A. of cooling medium
B. of freezing zone
C. of evaporator
D. at which refrigerant gas becomes liquid

Ans. D

Sol: The condensing temperature is the temperature at which a cooling medium changes phases from a gas to a liquid. When this phase change occurs, the

cooling medium condenses. The temperature at which a cooling medium condenses is dependent on the type of coolant and the condensing pressure.

27. With an increase in the thickness of insulation around a circular pipe, heat loss to surroundings due to _____.
A. convection increases, where as due to conduction decreases
B. convection decreases, where as due to conduction increases
C. both convection and conduction decreases
D. both convection and conduction increases

Ans. A

Sol: heat loss due to convection increase with increase surface area of circular pipe.
and decrease with increase between two end.

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

Ans. B

Sol: Dry bulb temperature is more than the wet bulb temperature.
only at relative humidity of 100%
DPT = WBT = DBT

29. If a mass of moist air in an airtight vessel is heated to a higher temperature, then _____.
A. specific humidity of the air increases
B. specific humidity of the air decreases
C. relative humidity of the air increases
D. relative humidity of the air decreases

Ans. D

Sol: Relative Humidity= $\frac{\text{actual vapor density}}{\text{saturation vapour density}} \times 100$
actual vapor density decreases with increases temperature and if actual vapor density decreases than relative humidity is also decrease

30. In a vapour compression refrigeration system, liquid to suction heat exchanger is used to _____.
A. keep the COP constant
B. prevent the liquid refrigerant from entering the compressor
C. sub-cool the liquid refrigerant leaving the condenser
D. sub-cool the vapour refrigerant from the evaporator

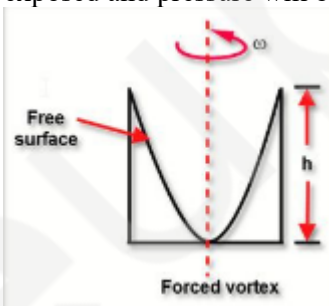
Ans. C

Sol: after exit compressor temperature of refrigerant will increases with pressure and in heat exchanger temperature of refrigerant will decrease with condensatation process of refrigerant while pressure will be constant.

31. A right-circular cylinder open at top is filled with water and rotated about its vertical axis at such speed that half the water spills out. What is the value of pressure at centre of the bottom?
A. One half its value when cylinder was full
B. One fourth its value when cylinder was full
C. Zero
D. Insufficient data

Ans. B/C

Sol: a cylinder rotating about the vertical axis has forced vortex flow. The free surface is paraboloid which has half the volume of cylinder of same height when half the liquid spills out, the centre of the bottom will be exposed and pressure will be zero.



32. At a point on a streamline, the velocity is 3 m/sec and the radius of curvature is 9 m. If the rate of increase of velocity along the streamline at this point is 1/3 m/sec/m, then the total acceleration at this point would be _____.
A. 1 m/sec2
B. 3 m/sec2
C. 1/3 m/sec2
D. $\sqrt{2}$ m/sec2

Ans. D

Sol: radial acceleration→
ar = V2/r = 32/9
ar = 1m/s2
tangential acceleration→
velocity increase by 1/3 m/s after traveling every 1m
it given that the particles travels 3m in 1sec (3m/sec)
or it travels 1m in 1/3sec
1/3 m/s after traveling every 1m or 1/3 m/s after traveling every 1/3 sec
at = $\frac{1/3}{1/3}$ = 1m/s2
a = $\sqrt{a_r^2 + a_t^2} = \sqrt{2}$ m/s^2

33. Which of the following statements is correct regarding an impulse turbine?
A. The steam is initially compressed in a nozzle from low pressure to high pressure.
B. The steam is initially expanded in a nozzle from low pressure to high pressure.
C. The steam is initially compressed in a nozzle from high pressure to low pressure.
D. The steam is initially expanded in a nozzle from high pressure to low pressure.

Ans. D

Sol: for steam impulse turbine a steam nozzle converts heat energy of steam into kinetic energy with reduction of pressure head

34. A draft tube is used with _____.
A. impulse turbine B. Pelton wheel turbine
C. reaction turbines D. axial turbine pumps

Ans. C

Sol: This draft tube at the end of the turbine increases the pressure of the exiting fluid at the expense of its velocity. This means that the turbine can reduce pressure to a higher extent without fear of back flow from the tail race.

35. For Newtonian fluid behavior, the shear stress exerted by the fluid is equal to the ____.
A. Fluid viscosity divided by the velocity gradient parallel to the direction of shear.
B. Fluid viscosity divided by the velocity gradient perpendicular to the direction of shear.
C. Product of the fluid viscosity and velocity gradient parallel to the direction of shear.
D. Product of the fluid viscosity and the velocity gradient perpendicular to the direction of shear.

Ans. D

Sol: $\tau \propto du/dy$

36. Which of the following are the advantages of impulse turbine over reaction turbines?
A. Occupies less space per unit power.
B. Compounding is not necessary for speed reduction as the rotor speeds are usually low.
C. Suitable for high power generation.
A. B and C only B. A only
C. C only D. A and C only

Ans. A

sol: because impulse turbines are high head turbine.

37. The compressors used in a gas turbine are typically of which type?
A. Centrifugal B. Centripetal
C. Reciprocating D. Axial

Ans. C

Sol: because reciprocating compressors/pump used for high pressure head.

38. Which turbine is also called as the propeller turbine?
A. Kaplan turbine B. Francis turbine
C. Pelton wheel D. Thompson turbine

And. A

Sol: The Kaplan turbine is called propeller-type water turbine due to its shape

39. According to Bernoulli's principle in fluid dynamics, for inviscid flow, increase in speed of fluid leads to which of the following?
A. Increase in pressure and/or increase in fluid's potential energy
B. Decrease in pressure and/or increase in fluid's potential energy
C. Increase in pressure and/or decrease in fluid's potential energy
D. Decrease in pressure and/or decrease in fluid's potential energy

Ans. D

Sol: According to Bernoulli's principle sum of pressure energy, potential energy and kinetic energy is constant.
and, increase in speed of fluid is only when if both pressure and potential energy decrease or one is constant and other is decrease.

40. The material commonly used for air craft gas turbine is _____.
A. stainless steel B. high alloy steel
C. duralumin D. titanium

Ans. C

Sol: Duralumin, strong, hard, lightweight alloy of aluminum, widely used in aircraft construction

41. The difference of absolute pressure and local atmospheric pressure is known as _____.
A. Negative pressure
B. Positive pressure
C. Gauge pressure
D. Hydraulic pressure

Ans. C

Sol: absolute pressure = atmospheric pressure + Gauge pressure
absolute pressure - atmospheric pressure = Gauge pressure

42. The sum of pressure head and elevation head is known as _____.
A. dynamic head B. static head
C. direct head D. potential head

Ans. B

Sol: Static pressure is felt when the fluid is at rest or when the measurement is taken when traveling along with the fluid flow. It is the force exerted on a fluid particle from all directions, and is typically measured with gauges and transmitters attached to the side of a pipe or tank wall. Since static pressure is what most pressure gauges measure, static pressure is usually what is implied when the term "pressure" is used in discussions.

43. Specific gravity is defined as the ratio of density of fluid and density of water at which temperature (in °C)?

A. 0 B. 100

C. 4 D. it is not dependent on temperature

Ans. C

Sol: at 4 ^{0}C liquid water has maximum density.

44. Falling drops of water become spheres due to the property of _____.

A. adhesion B. cohesion

C. surface tension D. viscosity

Ans. C

Sol: Liquid drops are spherical in shape because liquids have the tendency to have minimum surface area due to surface tension and out of all possible shapes, sphere has minimum surface area.

45. Fluid flow in a straight circular pipe is typically laminar in nature when the Reynolds number is _____.

A. Less than 2300 B. Less than 4000

C. More than 2300 D. More than 4000

Ans. A

Sol: →Re < 2400
→'low' velocity
→Fluid particles move in straight lines
→Layers of water flow over one another at different speeds with virtually no mixing between layers.

46. The reduction in fluid pressure that results when a fluid flows through a constricted section of a pipe is known as _____.

A. Orifice effect B. Bernoulli's principle

C. Secondary flow D. Venturi effect

Ans. D

Sol: The Venturi effect is the reduction in fluid pressure that results when a fluid flows through a constricted section (or choke) of a pipe

$P1 - P2 = \frac{\rho}{2}(v_2^2 - v_1^2)$

47. For a compressible flow, Mach Number (M) is given by which of the following expression? Where v = velocity of fluid in compressible flow c = speed of sound in air

A. $M = v/\sqrt{c}$ B. $M = c/v$

C. $M = v/c$ D. $M = v/c2$

Ans. C

Sol: Mach number (M) = the ratio of the speed of a body to the speed of sound in the surrounding medium.

48. Which type of forces dominates a fluid flow with a very high Reynolds Number (Rs ≈ 10000)?

A. Inertial B. Viscous

C. Reaction D. Divergent

Ans. A

Sol: Re = Inertial force/ Viscous force

49. To avoid cavitation in centrifugal pumps _____.

A. suction pressure should be low

B. delivery pressure should be low

C. suction pressure should be high

D. delivery pressure should be high

Ans. C

Sol: cavitation start where the pressure is low
From its vapor pressure and in pump low pressure is formed in only suction side.

50. For the continuity equation given by $\vec{\Delta}.\vec{V}=0$ to be valid, where $\vec{V}$ is the velocity vector, which one of the following is necessary condition?

A. Steady flow B. Irrotational flow

C. Inviscid flow D. Incomprehensible flow

Ans. D

Sol: for Incomprehensible flow
M1/t = M2/t
ρ1a1V1 = ρ2a2V2
ρ1 = ρ2 only in case of Incomprehensible flow
a1V1 = a2V2 continuity equation

51. Match the items in List 1 and 2.

List – 1		List - 2	
A	Compressible flow	1	Reynolds number
B	Free surface flow	2	Nusselt number
C	Boundary layer flow	3	Weber number
D	Pipe flow	4	Froude number
E	Heat convection	5	Mach number
		6	Skin friction coefficient

A. A-1, B-4, C-2, D-6; E-3

B. A-3, B-4, C-6, D-1; E-2

C. A-5, B-3, C-6, D-1; E-4

D. A-5, B-3, C-6, D-1; E-2

Ans. D

Soln: 1.The **Reynolds number** is an important parameter that describes whether flow conditions lead to laminar or turbulent flow

2. **Nusselt number**: A dimensionless parameter used in calculations of heat transfer between a moving fluid and a solid body

3. The **Weber Number** is a dimensionless value useful for analyzing fluid flows where there is an interface between two different fluids.

4. **the Froude number (Fr)** is a dimensionless number defined as the ratio of the flow inertia to the external field (the latter in many applications simply due to gravity)
5. **Mach number**: the ratio of the speed of a body to the speed of sound in the surrounding medium. It is often used with a numeral (as Mach 1, Mach 2, etc.) to indicate the speed of sound, twice the speed of sound, etc.
6. The skin friction coefficient is defined by: Where is the local wall shear stress, is the fluid density and is the free-stream velocity (usually taken outside of the boundary layer or at the inlet).

52. Match the items in List 1 and 2.

List – 1		List - 2	
A	Centrifugal compressor	1	Axial flow
B	Centrifugal pump	2	Surging
C	Pelton wheel	3	Priming
D	Kaplan turbine	4	Pure impulse

A. A-2, B-3, C-4, D-1 B. A-2, B-3, C-1, D-4
C. A-3, B-4, C-1, D-2 D. A-1, B-2, c-3, D-4

Ans. A

Soln: **Axial flow**: A Kaplan turbine is basically a propeller with adjustable blades inside a tube. It is an axial-flow turbine, which means that the flow direction does not change as it crosses the rotor.
Surging: Surge is defined as the operating point at which centrifugal compressor peak head capability and minimum flow limits are reached.
Priming: the pump casing must be filled with liquid before the pump is started, or the pump will not be able to function.
Pure Impulse: Pelton turbine gains mechanical energy purely due to change in kinetic energy of jet, not due to pressure energy change. Which means Pelton turbine is a pure impulse machine

53. A fluid whose shear stress is linearly proportional to the velocity gradient in the direction perpendicular to the plane of shear is called as _____.
A. Friction fluid B. Stress fluid
C. Newtonian fluid D. Cartesian fluid

Ans. C

Sol: Newtonian fluid is defined to be a Shear Stress is linearly proportional to the velocity gradient in the direction perpendicular to the plane of shear
Hence (c) is correct.

54. Euler's equation for the motion of liquid assumes that _____.
A. Fluid viscous
B. Fluid is homogeneous and incompressible
C. Velocity of flow is non-uniform over the section
D. Flow is unsteady along with stream line

Ans. B

Sol: Euler's equation is based on the following assumptions:
- The fluid is non-viscous.
- The fluid is homogeneous and incompressible.
- The flow is continuous, steady and along the streamline.
- The velocity of the flow is uniform over the section.
- No energy or force is involved in the flow.

Hence (B) is correct.

55. A flow whose stream line is represented by a curve, is called _____.
A. One-dimensional flow
B. Three dimensional flow
C. Two-dimensional flow
D. Four-dimensional flow

Ans. C

Fluid motion is said to be two-dimensional when the velocity at every point is parallel to a fixed plane, and is the same everywhere on a given normal to that plane. Thus, in Cartesian coordinates, if the fixed plane is the **XY** plane then we can express a general two-dimensional flow pattern in the form

$$\mathbf{v} = v_x(x, y, t)\,\mathbf{e}_x + v_y(x, y, t)\,\mathbf{e}_y.$$

56. The frictional resistance of a pipe varies approximately with _____ of the liquid.
A. pressure B. Square of velocity
C. velocity D. cube of the velocity

Ans. B

Sol: Experiment on fluid friction were conducted by Froude.
The frictional resistance of a pipe varies approximately with square of the liquid.

57. The cavitation a hydraulic machine is mainly due to _____.
A. Low velocity B. Low pressure
C. High velocity D. High pressure

Ans. B

Cavitation is formation of vapor bubbles in the liquid flowing through any Hydraulic Turbine. Cavitation occurs when the static pressure of the liquid falls below its vapor pressure. Cavitation is most likely to occur near the fast moving blades of the turbines and in the exit region of the turbine.

58. The stress, which is responsible for retaining water in a capillary tube above the free water surface of the water body in which the capillary tube is inserted, is called the ____.
A. Capillary compression
B. Capillary tension
C. Capillary pore pressure
D. None of these

Ans. B

Sol:

Cohesion is responsible for retaining water in capillary tube. Cohesion produces the phenomenon known as capillary tension.

59. A flow whose stream line is represented by a curve, is called _____.
A. One-dimensional flow
B. Three dimensional flow
C. Two-dimensional flow
D. four-dimensional flow

Ans. C

Fluid motion is said to be two-dimensional when the velocity at every point is parallel to a fixed plane, and is the same everywhere on a given normal to that plane

60. A single speed centrifugal pump, feeding a small water supply distribution system of a block of houses, works at _____.
A. Maximum efficiency
B. Minimum efficiency
C. Reduced efficiency
D. None of these

Ans. C

Single stage centrifugal pumps are the most common pump for fluid transfer in high flow rate, low pressure installations. If a lower flow rate or a higher pressure is needed over what a single stage centrifugal pump can provide, a multistage centrifugal pump is a better suited alternative. Single Speed Centrifugal Pump always works on reduced efficiency.

61. In under-damped vibrating system, the amplitude of vibration with reference to time_____.
A. increases linearly
B. increases exponentially
C. decreases linearly
D. decreases exponentially

Ans. D

Sol: For an under-damped system, the value of ζ can be found by examining the logarithm of the ratio of succeeding amplitudes of a system. This is called the logarithmic decrements. Hence (D) is correct.

62. A three rotor system has following number of natural frequencies _____.
A. 1 B. 2
C. 3 D. 4

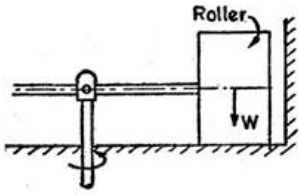
Ans. B

(1)A two rotor system has one natural frequency of vibration.

(2). **A three rotor system has two natural frequency**.

So Ans (B) is correct

63. The figure given below shows a crusher having several cylindrical rollers of weight W. The crushing force due to each roller will be:



A. W B. less than W
C. more than W D. unpredictable

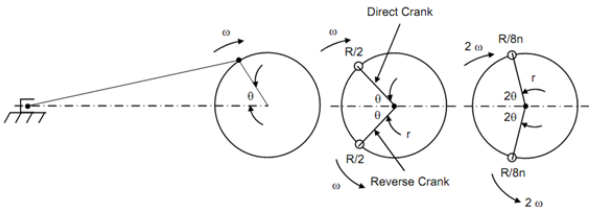
Ans. C

A crusher is a machine designed to reduce large rocks into smaller rocks, gravel, or rock dust. In Crusher, crushing strength comes for concrete cube testing results and in above question which will be more than W.

64. The principle of direct and reverse cranks is readily applicable to _____.
A. primary balance
B. secondary balance
C. balancing of in-line engines
D. partial primary balance

Ans. D

The direct and reverse crank balancing method (also known as contra-rotating mass balancing) aren't separate methods but rather one way of modelling the inertial effects of a reciprocating mass, such as a cylinder in an engine, as two separate masses rotating in opposite directions.



65. In order to facilitate the starting of locomotive in any position, the cranks of a locomotive with two cylinders are placed at following angle to each other _____.
A. 45° B. 90°
C. 135° D. 180°

Ans. B

Sol: The primary unbalanced force is maximum, when θ = 0° or 180°. Thus, the primary force is maximum twice in one revolution of the crank. The maximum primary unbalanced force is given by $FP(max) = m \cdot \omega 2 \cdot r$

Hence (B) is correct.

66. The critical speed depends on _____.
A. mass
B. stiffness
C. mass and stiffness
D. mass, stiffness and eccentricity

Ans. C

Sol: The critical speed depends upon mass, stiffness not eccentricity.

Hence (C) is correct.

67. If a more stiff spring is used in Hartnell governor, then the governor will be ____.
A. more sensitive
B. less sensitive
C. sensitively remains unaffected
D. isochronous

Ans. B

Sol: Stiffer spring becomes, less fluctuate due to its increased stiffness or tightness, thereby reducing the sensitiveness.
Hence (B) is correct.

68. A gear having 100 teeth is fixed and another gear having 25 teeth revolves around it, the centre lines of both gears being joined by an arm. How many revolutions will be made by gear of 25 teeth for one revolution of arm?
A. 4 B. 3
C. 5 D. 6

Ans. C

Sol:

Operation	Revolution of Arm	sun gear (S) (100 teeth)	planet gear(P) (25 teeth)
1Arm fixed,			
+1 rev, S	0	1	$-\frac{100}{25}$=-4
In ccw			
2multiplly x	0	x	-4x
3Add y	y	x+y	y-4x

N(S)=0
X+y=0
Hence x=-y
N(p)=y-4x
=y-4(-y)
=5y
Hence (c) is correct.

69. The power transmitted by a belt is maximum when the maximum tension in the belt compared to centrifugal tension is _____.
A. 2 times B. 3 times
C. 4 times D. 2.5 times

Ans. B

Sol: T-max tension in belt
t-centrifugal tension
T=3m(v)^2
t=m(v)^2
T=3t
Hence (B) is correct.

70. A rotating mass having moment of inertia of 30 kgm2 rotates at 800 rpm and is travelling in a curve of 170 metre radius at a speed of 240 km/hr. It will experience a gyroscopic reaction of _____.
A. 10 m kgf B. 100 m kgf
C. 1000 m kgf D. 10000 m kgf

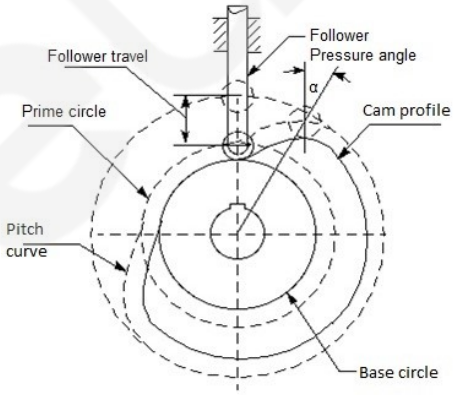
Ans. B

Sol: V=240×5÷18=66.66m/sec
I-moment of inertia
I=30kgm^2
W=2πN÷60
=2π(800)÷60
=83.77rad
w =(v) /r
=66.66/170
=0.3921rad
C=IWw
=30×83.77×0.3921
=981.5Nm/9.80.5
=100.101kgf
Hence (B) is correct.

71. Throw of a cam is the maximum distance of the follower from:
A. Base circle B. Pitch circle
C. Root circle D. Prime circle

Ans. A

Sol:



According to figure-
Base circle and follower has maximum distance
Hence (A) is correct.

72. The following is the inversion of slier crank mechanism
A. Whitworth quick return mechanism
B. Hand pump
C. Oscillating cylinder engine
A. only A B. only B
C. only C D. A, B and C

Ans. D

Sol: Second inversion
This inversion is obtained when link 2 (crank) is fixed.
Application- Whitworth quick return mechanism.
Third inversion
This inversion is obtained when link 3 (connecting rod) is fixed.
Application- Oscillatory engine
Fourth inversion
This inversion is obtained when link 4 (slider) is fixed.
Application- Hand pump
Hence (D) is correct.

73. The horse power transmitted by a belt is dependent upon
A. tension on tight side of belt
B. tension on slack side of belt
C. radius of pulley
D. speed of pulley
A. only A and B B. only B and C
C. only D D. A, B, C and D

Ans. D
if T_1= tension on tight side of belt
T_2= tension on slack side of belt
V= speed of pulley
r= radius of pulley
Power (P)=(T_1-T_2)xV/1000 in kW
so option D is correct

74. Which of the following is a lower pair?
A. Ball and socket
B. Piston and cylinder
C. Cam and follower
A. only A B. only B
C. only C D. A and B

Ans. D

Sol: In both ball and socket and piston cylinder there is surface contact between the two elements. Hence, they form a lower pair.
Hence (D) is correct.

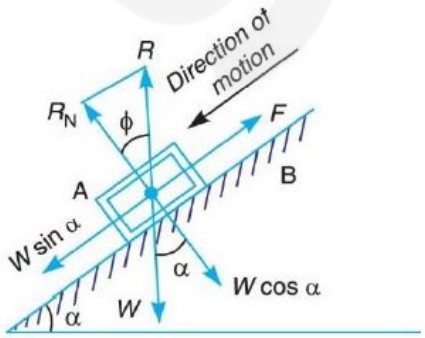
75. The distance between the centers of the rivets in adjacent rows of zigzag riveted joint is known as _____.
A. pitch B. back pitch
C. diagonal pitch D. diametric pitch

Ans. C

Sol: The smallest distance between centers of two rivet holes in adjacent rows of a zigzag riveted joint is called diagonal pitch.
Hence (C) is correct.

76. A body is resting on a plane inclined at angle 30° to horizontal. What force would be required to slide it down, if the coefficient of friction between body and plane is 0.3?
A. zero B. 1 kg
C. 5 kg D. None of these

Ans. A



Since Wsinα 〉 F, So no force required

77. A satellite is kept on moving in its orbit around the earth due to _____.
A. centrifugal force
B. centripetal force
C. gravitational force
D. resultant forces acting on satellite

Ans. B

Sol: $F = \frac{MV^2}{r}$
F-Cetripital force
M-mass of orbit
r-radius of earth
V-velocity of orbit
Centripetal force is acting to its centre and it is balance all the forces to rotate the orbit.
Hence (B) is correct.

78. The tension in the cable supporting a life is more when the lift is _____.
A. moving downwards with uniform velocity
B. moving upwards with uniform velocity
C. Stationary
D. moving upwards with acceleration

Ans. B

Sol: The tension in a cable supporting a lift moving upwards is twice the tension when the lift is moving downwards.
Hence (B) is Correct.

79. For steel, the ultimate strength in shear as compared to ultimate strength in tension is _.
A. same B. 1/2
C. 1/3 D. 2/3

Ans. D

Sol: The ultimate shear stress is 0.577 of ultimate tensile stress.
Hence (D) is correct.

80. In a simply supported beam, where the shear force is zero, the bending moment will be _.
A. zero B. maximum
C. minimum D. zero or minimum

Ans. B

Sol: *Simply supported beam*, *bending moment will* be *zero* at *supports*. And it *will* be maximum where *shear force is zero*.
Hence (B) is correct.

81. The stress in a body due to suddenly applied load compared to when it is applied gradually is _____.
A. same B. half
C. two times D. four times

Ans. C

Sol: Gradually applied load is given as , σ=(F/A)
here, work done is given as w=(F δL) / 2
and strain energy stored = (σ^2 / 2E) AL
Work done is equal to the strain energy stored.
(FδL)/2=(σ^2 /2E)AL
Therefore, σ=(F/A) ---------- (1)

Suddenly applied load is given as $\sigma=(2F/A)$, here work done = $(F\ \delta L)$
$(F\ \delta L) = (\sigma^2 / 2E)\ AL$
Therefore, $\sigma = (2F/A)$ ---------- (2)
From (1) and (2), it can be concluded that
Hence, suddenly applied load is twice the gradually applied load.
Hence (C) is correct.

82. Modulus of rigidity is defined as the ratio of _____.
A. longitudinal stress and longitudinal strain
B. volumetric stress and volumetric strain
C. lateral stress and lateral strain
D. shear stress and shear strain

Ans. D

Sol: Modulus of rigidity is defined as the ratio of shear stress to the shear strain.
Hence (D) is correct.

83. The intensity of stress which causes unit strain is called _____.
A. unit stress
B. bulk modulus
C. modulus of rigidity
D. modulus of elasticity

Ans. D

Sol: Stress=Force/Area
Stress/Strain=elasticity
Strain =1
Elasticity=Stress
Hence (D) is correct.

84. The property of a material by virtue of which a body returns to its original shape after removal of the load is called _____.
A. Plasticity B. Elasticity
C. Ductility D. Malleability

Ans. B

Sol: The property of a material by virtue of which a body returns to its original, shape after removal of the load is called elasticity.
Hence (B) is correct.

85. For which material the Poisson's ratio is more than unity?
A. steel
B. copper
C. aluminium
D. cast iron
A. only A B. only B
C. only C D. None of these

Ans. D

Sol:

Material	Poisson'sratio
Copper	0.33
aluminum-alloy	0.32
Steel	0.27
Cast iron	0.21

Hence (D) is correct.

86. A beam is loaded as cantilever. If the load at the end is increased, the failure will occur __.
A. in the middle B. at the tip below the load
C. at the support D. anywhere

Ans. C

Sol: Because maximum bending moment occur at fixed end. Hence (C) is correct.

87. At the principal planes _____.
A. the normal stress is maximum or minimum and the shear stress is zero
B. the tensile and compressive stresses are zero
C. the tensile stress is zero and the shear stress is maximum
D. no stress acts

Ans. A

Sol:

$$\tan 2\theta_{\tau-max} = -\left(\frac{\sigma_x - \sigma_y}{2\tau_{xy}}\right)$$

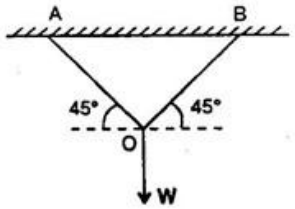
$$\tau_{max} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

When shear stress=0

$$\tau_{max} = \frac{|\sigma_x - \sigma_y|}{2}$$

Hence (A) is correct.

88. Two wires AO and BO support a vertical load W at O as shown in the figure below. The wires are of equal length and equal cross sectional area. The tension in each wire is equal to:

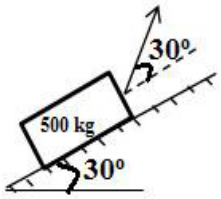


A. W/2 B. W
C. $\sqrt{2}W$ D. $W/\sqrt{2}$

Ans. D

Sol:
Tension in each wire=T
∑horizontal force=0
Horizontal force=Tcos (Q) in both side
Hence horizontal forces cancel.
∑vertical force=0
Tsin(Q)+Tsin(Q)=W
2Tsin(45)=W
$2/2^{1/2}T=W$
$T=W/2^{1/2}$
Hence(D) is correct.

89. A weight of 500 kg is held on a smooth plane, inclined at 30° to the horizontal by a force P acting 30° above the plane as shown in the figure below. The reaction of plane on the weight will be:

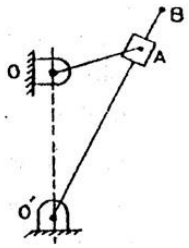


A. 500 N B. 250 N
C. 476 N D. 288 N

Ans. D

Sol: Equating of horizontal force
$500\sin(30)=P\cos(30)$
$P=500/3^{1/3}$
Equating of vertical force
$500/3^{1/3}\sin(30)+R=500\cos(30)$
R=288.67N
Hence (D) is correct.

90. Given figure shows a quick return mechanism. The crank OA rotates clockwise uniformly. OA = 2 cm, OO' = 4 cm. The ratio of time for forward motion to that for return motion is_____.



A. 0.5 B. 2
C. $\sqrt{2}$ D. 1

Ans. B

Sol: For return stroke
$\text{Cos}(Q''/2)=2/4$
$\text{Cos}(Q''/2)=\text{Cos}(60)$
$Q''=60\times2$
$Q''=120$
For forward stroke
$Q=360-120$
$=240$
$Q/Q''=240/120=2$
Hence (B) is correct.

91. Binding wire used to support the joints for soldering is made of _____.
A. aluminium B. copper
C. soft iron D. mild steel

Ans. C

Sol: Binding wire used to support the joints for soldering is made of soft iron.
Hence (C) is correct.

92. Which of the following is not a casting process?
A. Carthias process
B. extrusion
C. semi-centrifuge method
D. slush process

Ans. B

Sol: Extrusion process is not a casting process.
Hence (B) is correct.

93. Carburising flame is used to weld metals like _____.
A. steel
B. copper and Brass
C. aluminium, nickel, monel etc.,
D. carburised steel

Ans. C

The carburizing flame has excess acetylene, the inner cone has a feathery edge extending beyond it. This white feather is called the acetylene feather. It is used for Aluminium, Nickel etc.

94. The most commonly used flame in gas welding is
A. Neutral
B. Oxidising
C. Carburising
A. Only A B. only B
C. only C D. only A and B

Ans. A

Sol: A neutral flame is named neutral since in most cases will have no chemical effect on the metal being welded.
Hence (A) is correct.

95. In braze welding, the filler metal is
A. Distributed by capillary attraction
B. Melted and deposited at the point where the weld is to be made
C. Not required
A. only A B. only B
C. Both A and B D. only C

Ans. C

Sol: The filler metal flows into the gap between close-fitting parts by capillary action.
flows over the base metal (known as wetting) and is then cooled to join the work pieces together.
Hence (C) is correct.

96. Magnetic arc blow is _____.
A. a recent welding technique
B. used to weld materials
C. occurs when welding near equator
D. phenomenon of occurrence of splatter because of magnetic fields created in d.c. arc welding

Ans. D

Sol: Arc blow occurs in DC arc welding when the arc stream does not follow the shortest path between the electrode and the workpiece and is deflected forward or backward from the direction of travel or, less frequently, to one side.
Hence (D) is correct.

97. Preheating essential welding _____.
A. high speed steel B. stainless steel
C. cast iron D. german silver

Ans. C

Sol: A cast iron is an alloy of iron, carbon, and silicon, in which the amount of carbon is usually more than 1.7 percent and less than 4.5 percent. The overall weld

ability of cast iron is low and depends on the material type, complexity, thickness, casting complexity and need for machinability.
Hence (C) is correct.

98. Tool in the case of ultrasonic machining is made of _____.
A. HSS B. diamond
C. brass or copper D. stainless steel

Ans. C

Sol: Tools are made of relatively ductile materials like Brass, Stainless steel or Mild
Hence (C) is correct.

99. Thread rolling is somewhat like _____.
A. cold extrusion B. cold machining
C. cold rolling D. cold forging

Ans. C

Sol: Cold rolling follow the hot rolling process.
Hence (C) is correct.

100. The fatigue strength of metal is improved by setting up compressive stresses in the surface by process known as _____.
A. lacing B. shot-peening
C. hemming D. slugging

Ans. B

Sol: Peening is the process of working a metal's surface to improve its material properties, usually by mechanical means, such as hammer blows, by blasting with a shot (shot peening) , or blasts of light beams with laser peening.
Hence (B) is correct.

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