1. The _____ is a dimensionless quantity used in heat transfer calculations.
   A. Grashoff number B. Biot number
   C. Stanton number D. Prandtl number

Ans. B

Sol: simple index of the ratio of the heat transfer resistances inside of and at the surface of a body.

Biot number is defined as-

$Bi = \frac{L_c \times h}{K}$

h = film coefficient or heat transfer coefficient or convective heat transfer coefficient

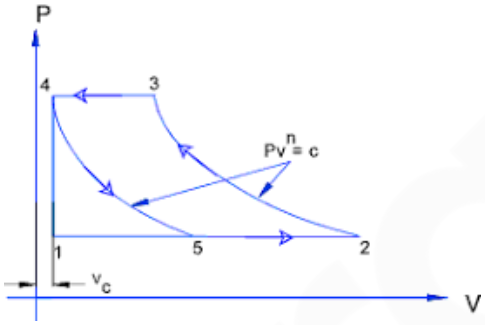
L_c = characteristic length, which is commonly defined as the volume of the body divided by the surface area of the body

K = thermal conductivity of the body

2. An ideal air compressor cycle (with clearance) on p-v diagram can be represented by _____ processes.
   A. one adiabatic, two isobaric, and one constant volume
   B. two adiabatic and two isobaric
   C. two adiabatic, one isobaric and one constant volume
   D. one adiabatic, one isobaric and two constant volume

Ans. B

Sol:



3. In a shell and tube heat exchanger, baffles are provided on the shell side to _____.
   A. Prevent the stagnation of shell side fluid
   B. Improve heat transfer
   C. Provide support for tubes
   D. All options are correct

Ans. D

Sol: Baffles are an integral part of the shell and tube heat exchanger design. A baffle is designed to support tube bundles and direct the flow of fluids for maximum efficiency.

4. The ratio of the thickness of thermal boundary layer to the thickness of hydrodynamic boundary layer is equal to (Prandtl number)n, where n is _____.
   A. -1/3 B. -2/3
   C. 1 D. -1

Ans. A

Sol. Dt - thermal boundary layer

D – Hydrodynamic boundary layer

$$\frac{Dt}{D} = (prandt\ number)^{\frac{-1}{3}}$$

5. In regarding nucleate boiling _____.
   A. The temperature of the surface is greater than the saturation temperature of the liquid
   B. Bubbles are created by expansion of entrapped gas or vapour at small cavities in the surface
   C. The temperature is greater than that of film boiling
   D. All options are correct

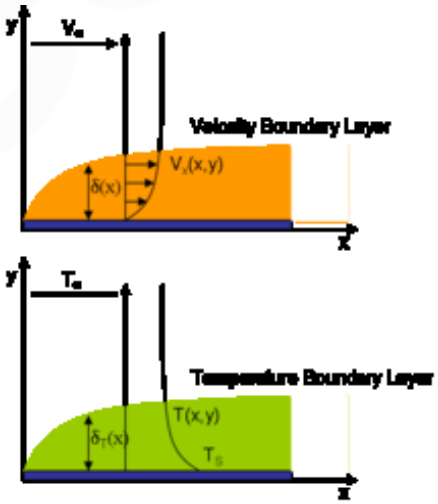
Ans. C

Sol: Nucleate boiling is a type of boiling that takes place when the surface temperature is hotter than the saturated fluid temperature by a certain amount but where the heat flux is below the critical heat flux.

6. Boundary layer is defined as _____.
   A. A thin layer at the surface where gradients of both velocity and temperature are small
   B. A thin layer at the surface where velocity and velocity gradients are large
   C. A thick layer at the surface where velocity and temperature gradients are large
   D. A thin layer at the surface where gradients of both velocity and temperature are large

Ans. D

Sol:



7. Two insulating materials of thermal conductivity K and 2K are available for lagging a pipe carrying a hot fluid. If the radial thickness of each material is the same _____.
   A. Material with higher thermal conductivity should be sued for the inner layer and one with layer and one with lower thermal conductivity for the outer
   B. Material with lower thermal conductivity should be used for the inner layer and one with higher thermal conductivity for the outer
   C. It is immaterial in which sequence the insulating materials are used
   D. None of these

Ans. B

Sol: Critical thickness of insulation for Ist and IInd Material =

$$(r_{c1}) = \frac{k}{h}, (r_{c2}) = \frac{2k}{h}$$

Hence $r_{c2} = 2r_{c1}$

so the first material should be used inside and second material should be use outside because it has higher critical radius

8. Critical thickness of insulation for spheres is given by _____.
   A. k/h B. k/4h
   C. h/2k D. 2k/h

Ans. D

Sol: 2k/h where *k* is the thermal conductivity of the insulation and *h* is the convection heat transfer coefficient on the outer surface.

9. Which surface will have the least emissivity?
   A. Smooth glass B. Plaster
   C. Aluminum foil D. Concrete

Ans. C

Sol: Emissivity is a measure of a material's radiating efficiency. An emissivity of 1.00 implies that the material is 100% efficient at radiating energy. An emissivity of 0.20 implies that the material radiates only 20% of that which it is capable of radiating.

10. The process of heat transfer from one particle of the body to another without the actual motion of the particle, is known as _____.
    A. Conduction B. Convection
    C. Radiation D. All options are correct

Ans. A

Sol: Process of heat transfer from one molecule of the body to another molecule without the motion of Particle.

11. The process of heat transfer from a hot body to a cold body is straight line, without affecting the intervening medium, is known as _____.
    A. Conduction B. Convection
    C. Radiation D. All options are correct

Ans. C

Sol: Heat is carried through the atomic vibration & electron motion.
Electromagnetic waves propagate rectilinearly, like light.

12. Heat is transferred from an electric bulb by _____.
    A. Conduction B. Convection
    C. Radiation D. All options are correct

Ans. C

Sol: (i) filament is heated due to conduction
(ii) Then there's convection, which drives a flow inside the bulb transferring the heat from the filament throughout the bulb via the movement of fluids (in this case that's argon gas).
(iii) but finally in last, heat is transferred from an electric bulb by radiation.

13. Assumption made in the Fourier's law is that the heat flow
    A. Is in steady state
    B. Though a solid medium in one dimension
    A. Only (A) B. Only (B)
    C. Both (A) and (B) D. None of these

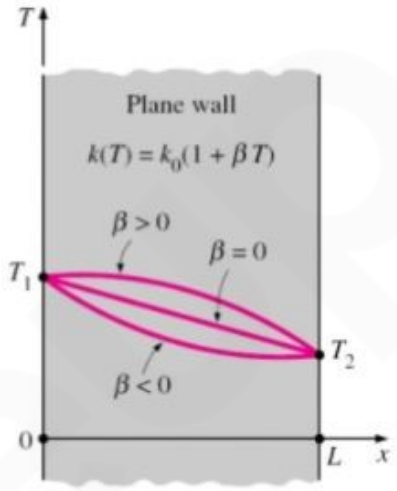
Ans. C

Sol: the time rate of heat transfer through a material is proportional to the negative gradient in the temperature and to the area, at right angles to that gradient, through which the heat flows

14. If thermal conductivity of a material of wall varies as K_0 (1 + αt), then the temperature at the centre of the wall as compared to that in case of constant thermal conductivity, will be _____.
    A. More B. Less
    C. Same D. Depend on other factors

Ans. A

It is no longer the case when the thermal conductivity changes with the temperature.



15. With increase in temperature, thermal conductivity of air _____.
    A. Increases B. Decreases
    C. Remains the same D. None of these

Ans. A

Sol: As the temperature of air increases average kinetic energy of the molecules increases, thus the average speed of molecules increases, thus the collision rate of the molecules increases. In air the thermal (kinetic energy of molecules) energy between the molecules is transported when they collide. So if the collision rate is more the rate of transportation of thermal energy between the molecules is more. Thus the conductivity of air increases with temperature.

16. Liquid metal having highest thermal conductivity is of _____.
    A. Sodium B. Potassium
    C. Lead D. Mercury

Ans. A

Sol: The most widespread liquid metals used in engineering are alkali metals. Among them sodium is first and foremost, used as a coolant of fast reactors and a working fluid of high-temperature heat pipes.

17. Minimum thermal diffusivity is of _____.
    A. Aluminum B. Rubber
    C. Iron D. Lead

Ans. B

Sol: thermal diffusivity $\propto$ thermal conductivity
Above this option thermal conductivity is low for rubber, so thermal diffusivity will also be low.

18. Critical radius of a hollow cylinder is defined as _____.
A. Outer radius which gives maximum heat flow
B. Outer radius which gives minimum heat flow
C. Inner radius which gives minimum heat flow
D. Inner radius which gives maximum heat flow

Ans. A

Critical radius of insulation depends on the thermal conductivity of the insulation k and the external convection heat transfer coefficient h . The rate of heat transfer from the cylinder increases with the addition of insulation for $r2 < r_{cr}$, reaches a maximum when $r_2 = r_{cr}$, and starts to decrease for $r_2 > rcr$. Thus, insulating the pipe may actually increase the rate of heat transfer from the pipe instead of decreasing it when $r_2 < {}_{rc}r$

19. Heat exchangers are used in
A. Condensers and boilers in steam plants
B. Radiators
C. Intercoolers and preheaters
D. Condensers and evaporators in refrigerators and air conditioners
A. Only A B. Only B
C. Only C D. A, B, C and D

Ans. D

Sol: A heat exchanger is a device used to transfer heat between a solid object and a fluid, or between two or more fluids. The fluids may be separated by a solid wall to prevent mixing or they may be in direct contact.

20. Automobile radiator is a heat exchanger of _____ type.
A. Counter flow B. Parallel flow
C. Cross flow D. Regenerator

Ans. C

Sol: A tube bundle carries a heating or cooling fluid (either gas or liquid), normally perpendicular to a gas flow which passes over the tubes and allows heat to be transferred between the fluids.

21. For a closed system, difference between the heat added to the system and work done by the gas, is equal to the change in _____.
A. Enthalpy B. Entropy
C. Internal energy D. Temperature

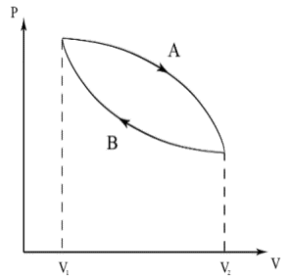
Ans. C

Sol: $Q = \Delta U + W$
Or, $\Delta U = Q - W$

22. The sequence of process that eventually returns the working substance to its original state, is known as _____.
A. Event
B. Thermodynamic cycle
C. Thermodynamic property
D. None of these

Ans. B

Sol: A thermodynamic cycle is a series of thermodynamic processes which returns a system to its initial state. Properties depend only on the thermodynamic state and thus do not change over a cycle. Variables such as heat and work are not zero over a cycle, but rather depend on the process.



23. According to Kelvin-Plank's statement, a perpetual motion machine of _____.
A. First kind is possible
B. First kind is impossible
C. Second kind is impossible
D. Second kind is possible

Ans. C

Sol: Perpetual motion machines of the second kind violate the Second Law of Thermodynamics. They convert thermal energy directly into mechanical work, with no exhaust heat being emitted; this violates the rule of the production of entropy that entropy in a system must always increase.

24. According to kinetic theory of gases, at absolute zero _____.
A. Specific heat of molecules reduces to zero
B. Kinetic energy of molecules reduces to zero
C. Volume of gas reduce to zero
D. Pressure of gas reduce to zero

Ans. B

Sol: Absolute zero is the point where where all molecules have no kinetic energy. It is a theoretical value (it has never been reached).

25. According to Gay-Lussac's law for perfect gases, the absolute pressure of given mass varies directly as _____.
A. Temperature
B. Absolute temperature
C. Absolute temperature, if volume remains constant
D. Product of absolute temperature and volume

Ans. C

Sol: $P \propto T$, or
$P/T \propto k$, or
$P_1/T_1 = P_2/T_2$

26. Three states of matter are distinguished with respect to molecules by the _____.
A. Atoms in molecules
B. Number
C. Orientation
D. Character of motion

Ans. D

Sol: In solids, the particles are tightly packed together and and motion is limited to vibration. In liquids, the particles have more movement, while in gases, they are spread out.

27. Equal volume of all gases, at the same temperature and pressure, contain equal number of molecules. This is according to _____.
A. Charle's law B. Avagardo's law
C. Joule's law D. Gay Lussac law

Ans. B

Sol: Avogadro's law states that the volume occupied by an ideal gas is directly proportional to the number of molecules of the gas present in the container. This gives rise to the molar volume of a gas, which at STP (273.15 K, 1 atm) is about 22.4 L. The relation is given by-
$V_1/n_1 = V_2/n2$
Where V_1 and V_2 are volume
And n_1 and n_2 are no. of mole

28. Specific heat of a gas, Cp = Cv, at
A. Absolute zero B. Critical temperature
C. Triple point D. All temperature

Ans. A

Sol: $C_p - C_v = -T[(\frac{\partial v}{\partial T})^2_{\text{at con. p}}/(\frac{\partial v}{\partial T})_{\text{at con. pres.}}]$
At absolute temperature (k=0)
$C_p - C_v = 0$, or
$C_p = C_v$

29. The specific heat at constant volume of solids obeys Debye's T3 law at _____.
A. High temperatures
B. Low temperatures
C. High pressures
D. All temperatures

Ans. D

Sol: It treats the vibrations of the atomic lattice (heat) as phonons in a box, in contrast to the Einstein model, which treats the solid as many individual, non-interacting quantum harmonic oscillators. The Debye model correctly predicts the low temperature dependence of the heat capacity, which is proportional to T^3 -the Debye T3 law.

30. A reversible process _____.
A. Must pass through a continuous series of equilibrium states
B. Leaves no history of the events in surroundings
C. Must pass through the same states on the reversed path as on the forward path
D. All options are correct

Ans. D

Sol: a reversible process is a process whose direction can be "reversed" by inducing infinitesimal changes to some property of the system via its surroundings, with no increase in entropy

31. In Red Wood Viscometer _____.
A. Absolute value of viscosity is determined
B. Part of the head of fluid is utilized in overcoming friction
C. Fluid discharges through orifice with negligible velocity
D. Comparison of viscosity is done

Ans. A

Sol: the value of viscosity of the liquid may be obtained by comparison with value of time for the liquid of known viscosity.

32. a rotameter is a device used to measure _____.
A. Velocity of fluid in pipes
B. Velocity of gauges
C. Votex flow
D. Flow of fluids

Ans. D

Sol: Rotameters (variable area meter) is a flow meter that measures volumetric flow of liquids and gases in volume/sec.

33. Steady flow occurs when _____.
A. Pressure does not change along the flow
B. Velocity does not change
C. Conditions change gradually with time
D. Conditions do not change with time at any point

Ans. D

Sol: steady flow is one in which the conditions (velocity, pressure and cross-section) may differ from point to point but DO NOT change with time.

34. If the particles of a fluid attain such velocities that vary from point to point in magnitude and direction as well as from instant, the flow is _____.
A. Uniform flow B. Steady flow
C. Turbulent flow D. Laminar flow

Ans. C

Sol: Turbulent flow is a type of fluid (gas or liquid) flow in which the fluid undergoes irregular fluctuations, or mixing, in contrast to laminar flow. In turbulent flow the speed of the fluid at a point is continuously undergoing changes in both magnitude and direction.

35. Flow occurring in a pipeline when a valve is being opened is _____.
A. Steady B. Unsteady
C. Laminar D Vortex

Ans. B

Sol: flow will be steady after unsteady flow when valve of pipeline is just open.

36. For measuring flow by Venturimeter, it should be installed in _____.
A. Vertical line
B. Horizontal line
C. Inclined line with upward flow
D. In any direction and in any location

Ans. D

Sol: a pressure drop occurs between the entrance and throat of the venturimeter. This pressure drop is measured using a differential pressure sensor if potential head are not considered.

37. A streamline is defined as the line _____.
A. Parallel to central axis flow
B. Parallel to outer surface to pipe
C. Of equal velocity in a flow
D. Along with the pressure drop is uniform

Ans. C

Sol: A streamline is a line that is tangential to the instantaneous velocity direction (velocity is a vector, and it has a magnitude and a direction).

38. The purpose of surge tank in a pipe line is to _____.
A. Smoothen the flow of water
B. Compensate friction losses in pipe
C. Prevent occurrence of hydraulic jump
D. Relieve pressure due to water hammer

Ans. B/D

Sol: A surge tank is a standpipe or storage reservoir at the downstream end of a closed aqueduct, feeder, dam, barrage pipe to absorb sudden rises of pressure, as well as to quickly provide extra water during a brief drop in pressure.

39. The resultant upward pressure of a fluid on a floating body is equal to the weight of fluid displaced by the body. This definition is according to _____.
A. Buoyancy
B. Equilibrium of a floating body
C. Archimedes' principle
D. Bernoulli's theorem

Ans. A

Sol: Buoyancy is the phenomena given by Archimedes which says the body experiences the upward force when it is partially or completely immersed in liquid.
Buoyancy force = weight of displaced liquid.

40. A balloon lifting in air follows the _____.
A. Law of gravitation
B. Archimedes principle
C. Principle of buoyancy
D. All options are correct

Ans. D

Sol: By comparing the weight of the object vs the weight of this displaced volume of gas or liquid, it can determine the object will float or sink

41. Hydraulic grade line as compared to the centre line of conduct _____.
A. Should be always above
B. Should be always below
C. Should always be parallel
D. May be above or below

Ans. A

Sol: The central line of the pipe will give only static head but hydraulic gradient line will give static head + pressure head

42. A Piezometer cannot be used for pressure measurement in pipes when _____.
A. Pressure difference is low
B. Velocity is high
C. Fluid in the pipe is a gas
D. Fluid is highly viscous

Ans. C

Sol: It cannot be used for measuring the pressure of gas because gas forms no free surface

43. A Hot Wire Anemometer is used for the measurement of _____.
A. Pressure of gases B. Velocity of gases
C. Viscosity of gases D. Viscosity of liquids

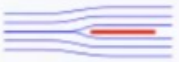
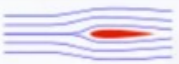
Ans. B

Sol: The technique depends on the convective heat loss to the surrounding fluid from an electrically heated sensing element or probe. If only the fluid velocity varies, then the heat loss can be interpreted as a measure of that variable.

44. Friction drag is generally larger than the pressure drag in _____.
A. Flow past a sphere
B. Flow past a cylinder
C. Flow past an airfoil
D. Flow past a thin sheet

Ans. B

Sol: Pressure drag (Form drag) arises due to the shape of the object and depends on the flow separation point.
Friction drag arises due to the friction between the fluid and surface of the object the flow is occurring around.

Shape and flow	Form Drag	Skin friction
	0%	100%
	~10%	~90%
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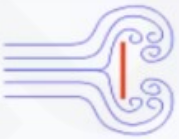
	100%	0%

45. If one of the wall moves in the direction of flow with uniform velocity while the other wall is stationary, then the resulting flow between parallel walls is called _____.
A. Plug flow B. Stoke's flow
C. Couette flow D. Euler's flow

Ans. A/C

Sol: Couette flow is the flow of a viscous fluid in the space between two surfaces, one of which is moving tangentially relative to the other. The flow is driven by virtue of viscous drag force acting on the fluid, but may additionally be motivated by an applied pressure gradient in the flow direction.

46. The ratio of the energy absorbed by the body to total energy falling on it is called _____.
A. absorptive power B. emissive power
C. emissivity D. None of these

Ans. A

Sol: $\text{absorptivepower,a} = \frac{\text{Amount of energy absorbed}}{\text{Amount of energy incident}}$
The absorptive power of a black body is 1 because it absorbs radiant energy of all wavelength incidents on it.

47. In a flow field, at the stagnation point _____.
A. Pressure is zero
B. velocity of fluid is zero
C. Pressure head is equal to velocity
D. All the velocity head is converted into pressure head

Ans. B

Sol: a stagnation point is a point in a flow field where the local velocity of the fluid is zero. Stagnation points exist at the surface of objects in the flow field, where the fluid is brought to rest by the object.

48. Viscosity is the most important property in the _____.
A. Travel of a bullet through air
B. Water jet issuing from a fire air
C. Formation of soap bubbles
D. Flow of castor oil through a tube
Ans. C
Sol: if viscosity will be more means fluid will be thick and formation of soap bubbles will difficult.

49. If pressure at any point in the liquid approaches the vapor pressure, liquid starts vaporizing and creates pockets or bubbles of dissolved gases and vapours. This phenomenon is _____.
A. Surface tension B. Adhesion
C. Vaporisation D. Cavitation
Ans. A
Sol: the tension of the surface film of a liquid caused by the attraction of the particles in the surface layer by the bulk of the liquid, which tends to minimize surface area.

50. The fluid forces considered in the Navier-Stokes equation are _____.
A. Gravity, pressure and viscous
B. Gravity, pressure and turbulent
C. Pressure, viscous and turbulent
D. Gravity, viscous and turbulent
Ans. A
Sol: forces considered in the Navier-Stokes equation-
1. Inertial forces
2. Pressure forces
3. Viscous forces
4. The external forces applied to the fluid

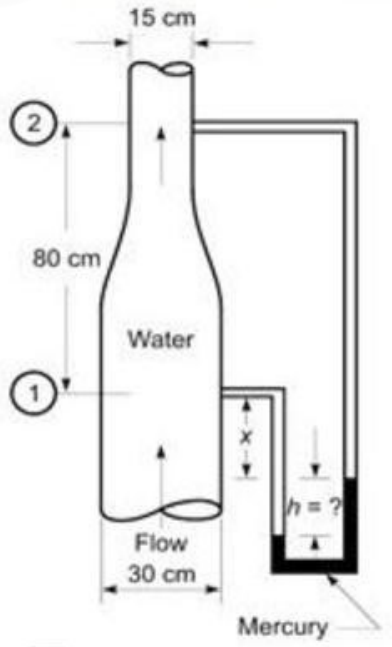
51. Hydraulic grade line for any flow system as compared to energy line is _____.
A. Above B. Below
C. At same level D. Uncertain
Ans. B
Sol: The energy grade line (EGL) and the hydraulic grade line (HGL) are defined as the height of the total Bernoulli constant while HGL is the height to which liquid would rise in a piezometric tube attached to the pipe HGL is obtained as EGL minus the velocity head . The fall of the EGL reflects the energy losses in the system. EGL drops slowly due to friction losses and it drops sharply due to a major loss (a valve or transition) or due to work extraction (to a turbine). The EGL can rise only if there is work addition (as from a pump).

52. To avoid vaporization in the pipe line, the pipe line over the ridge is laid such that t is not more than _____.
A. 2.4 m above the hydraulic gradient
B. 6.4 m above the hydraulic gradient
C. 10.0 m above the hydraulic gradient
D. 5.0 m above the hydraulic gradient
Ans. A/B
Sol: In order to avoid vaporization in the pipe line, the pipe line over the ridge is laid in such a way that it is not more than 6.4 m above the hydraulic gradient

53. The locus of elevations that water will rise in a series of pitot tube is called _____.
A. Hydraulic grade line
B. Pressure head
C. Energy grade line
D. head loss
Ans. C
Sol: A line that represents the elevation of energy head (in feet or meters) of water flowing in a pipe, conduit, or channel. The line is drawn above the hydraulic grade line (gradient) a distance equal to the velocity head ($V^2/2g$) of the water flowing at each section or point along the pipe or channel.

54. Pressure in Pascal at a depth of 1 m below the free surface of a body of water will be equal to _____.
A. 1 Pa B. 98.1 Pa
C. 981 Pa D. 9810 Pa
Ans. D
Sol: Pressure (p) = ρ ×g×h
Density of water (ρ) = 1000kg/m^3
Gravitational acceleration (g) = 9.81 m^3/sec
Depth (h) =1m
P=1000×9.81×1 = 9810Pa

55. Water flows up a tapered pipe as shown in the figure. What is the magnitude of the deflection h of the differential mercury manometer corresponding to a discharge of 126 L/s?
The friction in the pipe can be completely neglected.



A. 16.28 cm B. 17.28 cm
C. 19.28 cm D. 25.28 cm
Ans. C/B
Sol: P1= pressure at section 1
P2= pressure at section 2
ρ = density of water
ρm= density of mercury
x =distance
h =distance.
S=Density of mercury
Consider Section 1 as datum line

$\frac{p1}{r} + x + h = \frac{p2}{r} + x + Sh + 0.8$

$\frac{p1}{r} - \frac{p2}{r} - 0.8 = (S-1)h$

= (13.6-1)h

= 12.6h

By continuity

$Q = \frac{\pi}{4} \times D1\text{^}2 \times v1$

$Q = \frac{\pi}{4} \times D2\text{^}2 \times v2$

D_1=30cm

D_2=15cm

Hence

V_1=1.6977m/sec

V_2=6.79m/sec

$\frac{p1}{r} + \frac{v1^2}{2g} + z1 = \frac{p2}{r} + \frac{v2^2}{2g} + z2$

$\frac{p1}{r} - \frac{p2}{r} + 0 - 0.8 = \frac{v1^2 - v2^2}{2g}$

$=\frac{6.79^2 - 1.6977^2}{2\times 9.81}$

=2.2034

$\frac{p1}{r} - \frac{p2}{r} - 0.8 = 12.6h$=2.2034

h =0.175m

h=17.5cm

56. If a pump is handling water and its discharging a certain flow Q at a constant total dynamic head requiring a definite B.H.P., the same pump when handling a liquid of specific gravity 0.75 and viscosity nearly same as of water would discharge
A. same quantity of liquid
B. 0.75Q
C. Q/0.75
D. 1.5Q

Ans. A

Sol: If the discharge of water is Q at constant dynamic head and having definite B.H.P if a liquid is having specific gravity .75
Then the discharge is 0.75Q because Q is depend Specific gravity.

57. A 20cm diameter pipe 5000 metres long conveys 0.05 cumec of water which is to be pumped through a height of 6 metres. What is the horse power required by the pump, if its efficiency is 75%? (take 4f=0.006)
A. 74.2 HP
B. 74 HP
C. 75 HP
D. 50 HP

Ans. A

Sol: $Z_2 - Z_1$ = 6m

Efficiency (n) =75%

4f = 0.006

Loss of head in the pipe line,

$hf = \frac{4flQ^2}{3.0257d^5}$

$hf = \frac{4\times 0.006\times 6\times 0.05^2}{3.0257(02)^5}$

hf =77.46m

Head to be developed by the pump,

h = 77.46 + 6 = 83.46m

$\text{HP required} = \frac{WQh}{75n}$

$\text{HP required} = \frac{100 \times 0.05 \times 83.46}{75 \times 0.75}$

=74.2HP

58. For laminar flow in a pipe, V is equal to
A. Umax
B. 0.5 Umax
C. 0.25 Umax
D. 2 Umax

Ans. B

Sol: average velocity = (discharge/area of pipe)

$$Discharge = \frac{\pi d^2 u(max.)}{4}$$

u (max) = maximum velocity

59. Water at 20℃ flowing through a 20 cm diameter pipe. Take kinematic viscosity of water at 20℃ is equal to 0.0101 stoke. Assume that the changes from lamina to turbulent at Re=2320. The critical velocity will be _____.
A. 1.117 cm/sec
B. 11.17 cm/sec
C. 111.7 cm/sec
D. 1.117 m/sec

Ans. A

Sol: $Re=\frac{\rho vd}{\mu}=\frac{2320\times .0101\times 1000}{20\times 1000}$ =1.1716cm/sec

60. Surge wave is an example of _____.
A. Steady uniform flow
B. Steady non-uniform flow
C. Unsteady uniform flow
D. Unsteady non-uniform flow

Ans. D

Sol: Because surge wave have flow at varying rates through a duct of non-uniform cross-section.

61. Quick return mechanism is an inversion of _____.
A. Four bar chain
B. Single slider crank chain
C. Double slider crank chain
D. Crossed slider crank chain

Ans. B

Sol: The slider-crank mechanism is a particular four-bar linkage configuration that converts linear motion to rotational, or vice versa if it having single chain then it is called single chain slide crank its vice versa is also called quick return mechanism

62. In gears, interference takes place when _____.
A. Tip of a tooth of a mating gear digs into the portion between base and root circles
B. Gears do not move smoothly in the absence of lubrication
C. Pitch of the gear is not same
D. Gear teeth are undercut

Ans. A

Sol: because interference take place due to frictional forces in gear when tooth dig between the circle between root and base it causes frictional force

63. In a multiple V belt drive, when a single belt is damaged, it is preferable to change the complete set to _____.
A. Reduce vibration
B. Reduce slip
C. Ensure uniform loading
D. Ensure proper alignment

Ans. D/C

For uniform loading it is preferable to change the complete set of V-belt drive.

64. The center of gravity of the coupler link in a 4-bar mechanism would experience _____.
A. No acceleration
B. Only linear acceleration
C. Only angular acceleration
D. Both linear and angular accelerations

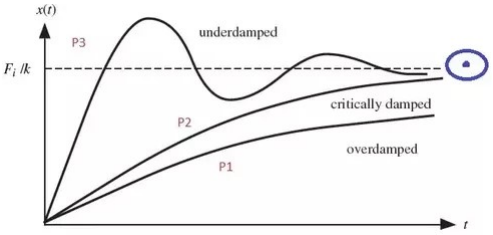
Ans. D

Sol: A four-bar linkage, also called a four-bar, is the simplest movable closed chain linkage. It consists of four bodies, called bars or links, connected in a loop by four joints. Generally, the joints are configured so the links move in parallel planes, and the assembly is called a planar four-bar linkage and in such type of linkages the body moves in both linear and angular motions so it have both kind of velocities

65. The amplitude of underdamping a small damping varies with time as _____.
A. Linearly B. Arithmetically
C. Geometrically D. Exponentially

Ans. D

Sol:



66. Whirling speed of a shaft coincide with the natural frequency of the _____.
A. Longitudinal vibration
B. Transverse vibration
C. Torsional vibration
D. Coupled between torsional vibration

Ans. B

Sol: Transverse vibrations because whirling of the shaft is dependent on the transverse vibration also it may be rotational vibration.

67. A mass of 1 kg is attached to the end of a spring with stiffness 0.7 N/mm. The critical damping coefficient of this system is _____.
A. 1.40 Ns/m B. 18.522 Ns/m
C. 52.92 Ns/m D. 529.20 Ns/m

Ans. C

K=0.7N/mm=700N/m
M=1kg
Coefficient=2×Sqrt(KM).
=2 × Sqrt (700*1).
= 52.92 N-s/m

68. Rankine's theory of failure is applicable for which of the following type of materials?
A. Brittle B. Ductile
C. Elastic D. Plastic

Ans. A

Sol: (A) Rankine's Theory assumes that failure will occur when the maximum principal stress at any point reaches a value equal to the tensile stress in a simple tension specimen at failure. This theory does not take into account the effect of the other two principal stresses. Rankine's theory is satisfactory for brittle materials, and not applicable to ductile materials.

69. The shock absorbing capacity of a bolt can be increased by _____.
A. Tightening it properly
B. Increasing shank diameter
C. Grinding the shank
D. Using washer

Ans. C

Sol: capacity of a the shank bolt is the shock absorbing increase by grinding
Because if we turn down the shank it is subjected to high stress that increases the strain absorbing capacity

70. Which if the following key is under compression rather than in being shear when under load?
A. Saddle B. Barth
C. Feather D. Kennedy

Ans. B

Sol: The *Barth key* is a square key with bottom two corners beveled. This double beveling ensures that the key will fit tightly against the top of the keyway when the drive is in either direction and lessens the tendency to twist.

71. Shaft is subjected to which of the following stresses?
A. Bending
B. Torsional
C. Both bending and torsional
D. None of these

Ans. C

Sol: it is subjected both kind of stresses because shaft is working under dynamic load and dynamic load have both kind of stresses to

72. Which of the following is self-aligning bearing?
A. Conical B. Spherical
C. Rectangular D. None of these

Ans. B

Sol: Self-aligning ball bearings have two rows of balls, a common sphered raceway in the outer ring and two deep uninterrupted raceway grooves in the inner ring. They are available open or sealed. The bearings are insensitive to angular misalignment of the shaft relative to the housing.

73. Which of the following is Trapezoidal thread?
A. Acme B. Square
C. Buttress D. All options are correct

Ans. A

Sol: **Trapezoidal thread forms** are screw thread profiles with trapezoidal outlines. They are the most common forms used for leadscrews (power screws). They offer high strength and ease of manufacture. They are typically found where large loads are required, as in a vise or the leadscrew of a lathe. Standardized variations include multiple-start threads, left-hand threads, and self-centering threads (which are less likely to bind under lateral forces).

74. The efficiency of self-locking screw is _____.
A. More than 50% B. Less than 50%
C. Equal to 50% D. None of these

Ans. B

Sol: Efficiency of self-locking screws is less than 1/2 or 50%. If the efficiency is more than 50%, then the screw is said to be overhauling.

75. The most suitable bearing for carrying very heavy loads with slow speed is _____.
A. Hydrodynamic bearing
B. Ball bearing
C. Roller bearing
D. Hydrostatic bearing

Ans. D

Sol: Hydrostatic bearings are externally pressurized fluid bearings, where the fluid is usually oil, water or air, and the pressurization is done by a pump.

76. The outside diameter of a hollow shaft is twice it's inside diameter. The ratio of its torque carrying capacity to that of a solid shaft of the same material and the same outside diameter is _____.
A. 15/16 B. 3/4
C. 1/2 D. 1/16

Ans. A

The strength of a solid shaft in torsion is given by,
T1(solid shaft) = (π/16)*max stres×D^4
T1=$\frac{\pi}{16} \times s \times D^4$
T2 (hollow shaft)=(π/16)*(max stres)*(D^4-d^4)/D
. T2=$\frac{\pi}{16} \times s \times (2D^4 - D^4)$
$\frac{T1}{T2}$= 15/16

77. A solid shaft can resist a bending moment of 3 kNm, and a twisting moment of 4 kNm together, then the maximum torque that can be applied is _____.
A. 7.0 kNm B. 3.5 kNm
C. 4.5 kNm D. 5.0 kNm

Ans. D

Equivalent Torque=

$$T_0 = \sqrt{M^2 + T^2} = \sqrt{3^2 + 4^2} = 5\,\text{kNm}$$

78. Under torsion, brittle materials generally fail _____.
A. Along a plane perpendicular to its longitudinal axis
B. In the direction of minimum tension
C. Along surfaces forming a 45° angle with the longitudinal axis
D. Not in any specific manner

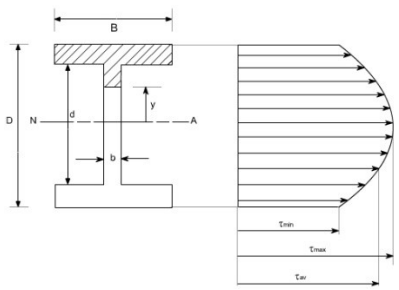
Ans. C

Sol: because torsion take place at the principle axis of specimen by the eular Bernoulli equtions

79. The shear stress distribution over a rectangular cross-section of a beam follows _____.
A. A straight line path B. A circular path
C. A parabolic path D. An elliptical path

Ans. C

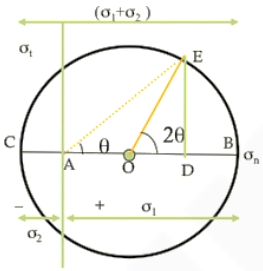
Sol:



80. When two mutually perpendicular principal stresses are unequal but alike, the maximum shear is represented by _____.
A. The diameter of the Mohr's circle
B. Half the diameter of the Mohr's circle
C. One-third the diameter of the Mohr's circle
D. One-fourth the diameter of the Mohr's circle

Ans. B

Sol:



Its half of the dia. Shows the maximum stress at angle is 45° so radius of the circle shows the maximum stress.

81. The plane of maximum shear stress has normal stress that is _____.
A. Maximum B. Minimum
C. Zero D. None of these

Ans. C

Sol: because of maximum shear stress theory according to it the plane at which the maximum shear stress acts then there will be no normal principle stresses.

82. Consider the following theories of failure:
A. Maximum stress theory
B. Maximum strain theory
C. Maximum shear stress theory
D. Maximum energy or distortion theory
The most suitable for ductile material is
A. A and B B. A and C
C. A and D D. C and D

Ans. D

Sol: 1. Maximum Principal Stress theory also known as RANKINE'S THEORY
2**. Maximum Shear Stress theory** or GUEST AND TRESCA'S THEORY
3. Maximum Principal Strain theory also known as St. VENANT'S THEORY
4. Total Strain Energy theory or HAIGH'S THEORY
5**. Maximum Distortion Energy theory** or VONMISES AND HENCKY'S THEORY "c" and "d" option is correct.

83. For ductile materials, the most appropriate failure theory is _____.
A. Maximum shear stress theory
B. Maximum principal stress theory
C. Maximum principal strain theory
D. Shear strain energy theory

Ans. A

Sol: "Ductile materials have typically equal strength in tension and compression, whereas compressive strength of brittle material is much higher than tensile strength."
Maximum shear stress theory assumes that yield strength in tension is equal to yield strength in compression hence this theory is best suited for ductile material and not brittle material.

84. All the failure theories give nearly the same result _____.
A. When one of the principal stresses at a point is larger in comparison to the other
B. When shear stresses act
C. When both the principal stresses are numerically equal
D. For all situations of stress
Ans. A
Sol: because situation reassemble the uniaxial tension test

85. from the hypothesis given by Rankine, the criteria for failure of brittle material is _____.
A. Maximum principal stress
B. Maximum strain energy
C. Maximum shear stress
D. Maximum shear strain energy
Ans. A
Sol: Maximum principal stress theory is best suited for the brittle materials because brittle materials do not fail by yielding but they fail by fracture.

86. In a closed helical spring subjected to an axial load, other quantities remaining the same, if the wire diameter is doubled and mean radius of the coil is also doubled, then stiffness of spring when compared to original one will become _____.
A. Twice B. Four times
C. Eight times D. Sixteen times
Ans. A
spring stiffness: The stiffness is defined as the load per unit deflection therefore

$$k = \frac{W}{x} = \frac{W}{\frac{8wD^3.n}{G.d^4}}$$

Therefore

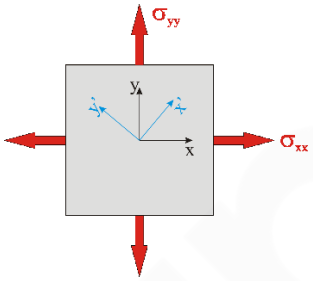
$$k = \frac{G.d^4}{8.D^3.n}$$

W = axial load
D = mean coil diameter,d = diameter of spring wire,n = number of active coils,C = spring index = D / d For circular wires,l = length of spring wire,G = modulus of rigidity,x = deflection of spring

87. The Poisson's ratio for most of the materials is close to _____.
A. 1 : 2 B. 1 :3
C. 1 : 4 D. 1 : 5
Ans. B
Sol: This data is experimentally proved For perfect isotropic Material, Poisson's Ratio: 1:4, but for most materials it lies between 0.28 to 0.33 so Option B is correct

88. True stress represents the ratio of _____.
A. Average load and average are
B. Average load and maximum area
C. Maximum load and maximum area
D. Instantaneous load and instantaneous area
Ans. D
Sol: true stress is define as the ratio of instantaneous force and instantaneous area

89. For an element under the effect of biaxial state of normal stress, the normal stresses are on a 45° plane is equal to _____.
A. Difference of normal stresses
B. Sum of normal stresses
C. Half of the sum of normal stresses
D. Half of the difference of normal stresses
Ans. C



$$\sigma = \frac{\sigma_x + \sigma_y}{2} \; when, \theta = 45^0$$

90. For a thin spherical shell subjected to internal pressure, the ratio of volumetric strain to diametrical strain is _____.
A. 5 : 4 B. 3 : 2
C. 2 : 1 D. 3 : 1
Ans. D
Volume of sphere V=
Taking differential on both side

$$\delta V = 3 \times \frac{\pi}{6} \times d^2 \delta d$$

$$\frac{\delta V}{V} = 3\frac{\delta d}{d}$$

So, option D is correct.

91. Stud and projection welding belong to the following category of welding _____.
A. gas welding B. arc welding
C. resistance welding D. pressure welding
Ans. C
Sol: Stud welding, also known as "drawn arc stud welding", joins a stud and another piece of metal together by heating both parts with an arc. The stud is usually joined to a flat plate by using the stud as one of the electrodes. The polarity used in stud welding depends on the type of metal being used. Welding aluminum, for example, would usually require direct-current electrode positive (DCEP). Welding steel would require direct-current electrode negative (DCEN).

92. Electrode gets consumed in the following welding process _____.
A. gas B. resistance
C. thermit D. arc
Ans. D
Sol: electrode are useful in arc welding only. One of the most common types of arc welding is shielded metal arc welding (SMAW), which is also known as manual metal arc welding (MMAW) or stick welding. An electric current is used to strike an arc between the base material and a consumable electrode rod or stick.

93. The strength of a properly welded joint as compared to base metal would be _____.
A. same B. more
C. less D. unpredictable
Ans. B
Sol: The strength of weld bead that is the portion which is welded is always higher and that is because of the **Alloy formation.**

94. Oxygen to acetylene ratio in case of carburising flame is _____.
A. 0.5: 1 B. 0.9: 1
C. 1: 1 D. 1 : 1.2
Ans. B
Sol: In oxy-acetylene welding, a **carburizing flame** is one with little oxygen, which produces a sooty, lower-temperature **flame and oxygen to acetylene ratio is 0.9:1**

95. For steel castings, the following type of sand is better _____.
A. fine-grain B. coarser-grain
C. medium grain D. fine-grain, coarser-grain and medium grain all are equally good
Ans. B
Sol: because

96. Hot tear refers to _____.
A. casting defect
B. process of fabrication
C. process of heat treatment
D. weathering of non-ferrous materials
Ans. A
It is a defect in which when the material in process to solidify some crack are visible this is called hot tear it causes due to gases escape from the molten metals.

97. Slick in a foundry shop is used to _____.
A. make and repair corners in a mould
B. thoroughly mix up moulding sand
C. make venting holes in the mould
D. prepare gates
Ans. A
Sol: because Foundry shop is the place where the metal casting is prepared by melting and pouring the molten metal into moulds

98. Which of the following processes would produce strongest components?
A. die casting B. hot rolling
C. extrusion D. forging
Ans. A
Sol: **Die casting** is a metal casting process that is characterized by forcing molten metal under high pressure into a mold cavity. The mold cavity is created using two hardened tool steel dies which have been machined into shape and work similarly to an injection mold during the process. Most die castings are made from non-ferrous metals, specifically zinc, copper, aluminium, magnesium, lead, pewter and tin-based alloys. Depending on the type of metal being cast, a hot- or cold-chamber machine is used.

99. A sprue hole is _____.
A. a casting defect
B. a hold made for riveting
C. a blind hole in jigs
D. an opening in mould for pouring molten metal
Ans. D
Sol: sprue: it is define as the passage by which molten metal will pour into the mould cavity

100. Coining is the operation of _____.
A. cold forging B. hot forging
C. cold extrusion D. piercing
Ans. A
Sol: **Coining** is a closed die forging process, in which pressure is applied on the surface of the forging in order to obtain closer tolerances, smoother surfaces and eliminate draft.

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