1. Provision of fines on a given heat transfer surface will be more if there are _____.
   A. Fewer number of thin fins
   B. Fewer number of thick fins
   C. Large number of thick fins
   D. Large number of thin fins

Ans. C

Sol: Maximum no. of fins on a given heat transfer surface will be more.
Thick fins absorb the more heat and also rejecting the more heat.
Hence (C) is correct.

2. Which of the following would lead to a reduction in thermal resistance?
   A. In conduction, reduction in the thickness of the material and an increase in the thermal conductivity.
   B. In convection, stirring of the fluid and cleaning the heating surface
   C. In radiation, increasing the temperature and reducing the emissivity
   D. All options are correct

Ans. D

Soln:
Thermal resistance is the resistance of a particular medium or system to the flow of heat through its boundaries and is dependent upon geometry and thermal properties of the medium such as thermal conductivity.
Option A,B,C are correct because it is applicable in all three mode of heat transfer.

3. Inspite of large heat transfer coefficients in boiling liquids, fins are used advantageously when the entire surface is exposed to _____.
   A. Nucleate boiling B. Film boiling
   C. Transition boiling D. All modes of boiling

Ans. B

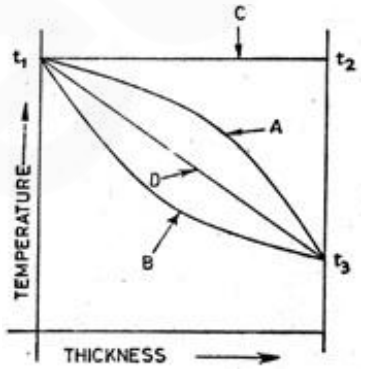
Sol: Film boiling i.e. transition and nucleate are of great importance.
Hence (B) is correct.

4. The parameter(s) responsible for loss of heat from a hot pipe surface in a room without fans would include _____.
   A. Temperature of the surface and air in the room
   B. Emissivity of the surface
   C. Length and diameter of the pipe
   D. All options are correct

Ans. D

Heat loss depends on geometry, mode and Temperature so option D is correct.

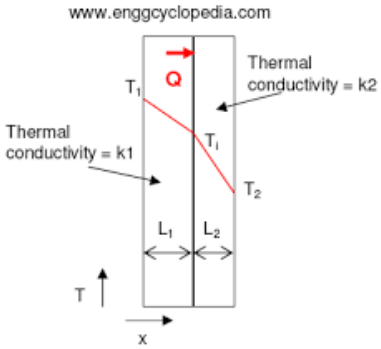
5. The figure given below shows the variation of temperature across the thickness of materials with different thermal conductivities under steady states. Curve C will be applicable when thermal conductivity of the material _____



   A. increases with increase in temperature
   B. decreases with increase in temperature
   C. is very large
   D. is constant at all temperatures

Ans. C

Soln:



from figure Ans C is correct.

6. On a summer day, a scooter rider feels more comfortable while on the move than while at a stop light because _____.

A. An object in motion captures less solar radiation

B. Air in transparent to radiation and hence it is cooler than the body

C. More heat is lost by convection and radiation while in motion

D. Air has low specific heat and hence it is cooler

Ans. C

Sol: All materials radiate thermal energy based on their temperature. The hotter an object, the more it will radiate and also the situation corresponds to forced convection when the scooter is in motion and the convective heat transfer coefficient for forced convection is greater than that for free convection.

7. In radiative heat transfer, a gray surface is one _____.

A. Which appears gray to the eye

B. Whose emissivity is independent of wavelength

C. Which has reflectivity equal to zero

D. Which appears equally bright from all directions

Ans. B

Sol: A gray surface, or graybody, is a surface that reflects/absorbs a given fraction of the thermal radiation a blackbody surface would absorb. More importantly, the graybody/blackbody fraction is independent of radiation wavelength. Hence (B) is correct.

8. The property of a working substance, which increases or decreases according to the heat supplied or removed in reversible manner, is called _____.

A. Enthalpy B. Entropy

C. Reversibility D. None of these

Ans. B

Sol: Entropy: Entropy is the extensive property of the system (depends on the mass of the system) and its unit of measurement is J/K (Joule per degree Kelvin). As per question,the property of a working substance, which increases or decreases according to the heat supplied or removed in reversible manner, is called Entropy.

Hence (B) is correct.

9. Triple point _____.

A. Occurs in a mixture of two or more gases

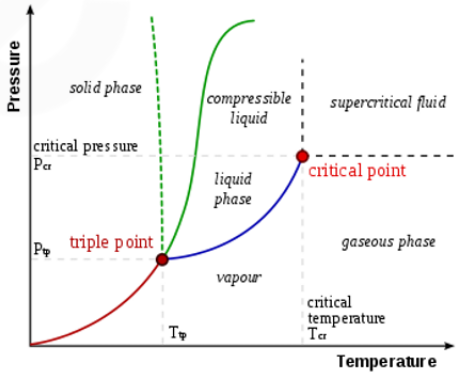
B. Is the point, where three phases exists together

C. Occurs in sublimation

D. None of these

Ans. B

Sol: Triple point of a substance is the temperature and pressure at which the three phases (gas, liquid, and solid) of that substance coexist in thermodynamic equilibrium.



Hence (B) is correct.

10. Non quasistatic process is _____.

A. Free expansion of gas

B. Expansion of a gas in a cylinder under constant pressure

C. Rapid compression of a gas in a cylinder

D. Gradual compression of a gas in a cylinder

Ans. A

Sol: All natural processes occurring in the universe are irreversible and non-quasi-static.

Hence non Quasistatc process is Free expension process.

Hence (A) is correct.

11. Isentropic flow is _____.
    A. Reversible adiabatic flow
    B. Irreversible adiabatic flow
    C. Frictionless fluid flow
    D. None of these

Ans. A

Sol: A simple more common definition of isentropic would be No change in entropy. An isentropic flow is a flow that is both adiabatic and reversible.
Hence (A) is correct.

12. In all reversible process, entropy of the system _____.
    A. Increases
    B. Decreases
    C. Remains same
    D. None of these

Ans. A/C

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.
Hence (A) is correct.

13. In isothermal expansion, work done by gas depends upon _____.
    A. Atomicity of gas only
    B. Expansion ratio only
    C. Adiabatic index
    D. Both Atomicity of gas and expansion ratio

Ans. D

Sol: $W=mRT\ln(V2/V1)$
$V2/V1=r$
r-Expension ratio
m- no. of mole
Hence (D) is correct.

14. The difference between two specific heats, Cp & Cv for a gas represents ____.
    A. Increase in kinetic energy of gas molecules
    B. Increase in potential energy of gas molecules
    C. External work done
    D. Increase in volume

Ans. C

Sol: $C_P - C_V = R$
Cp-Heat capacity at constant pressure
Cv- Heat capacity at constant pressure
R-Universal gas constent
When the gas is heated at constant pressure, the piston moves outward and work is performed by the gas.
Hence (C) is correct.

15. The universal gas constant of a gas is the product of molecular weight of the gas and __.
    A. Gas constant
    B. Specific heat at constant pressure
    C. Specific heat at constant volume
    D. None of these

Ans. A

Sol: The universal gas constant of a gas is the product of molecular mass of the gas and the gas constant.
ideal gas equation
$pV = mRT$.
m = mass
R = characteristics gas constant
T = temperature
p = pressure and
V = volume.
m=n*M
where
M = molecular mass
n = no of moles.
So, $pV = nMRT$..
Hence (A) is correct.

16. The temperature of a gas is a measure of _____.
    A. Average distance between gas molecules
    B. Average kinetic energy of gas molecules
    C. Average potential energy of gas molecules
    D. None of these

Ans. B

Sol: The temperature of a gas is a measure of the average translational kinetic energy of the molecules. In a hot gas.the molecules move faster than in a coldgas; the mass remains the same, but the kinetic energy, and hence the temperature, is greater because of the increased velocity of the molecules.
Hence (B) is correct.

17. A perpetual motion machine of the first kind i.e. a machine which produces power without consuming any energy is _____.
A. Possible according to first law of thermodynamics
B. Impossible according to first law of thermodynamics
C. Impossible according to second law of thermodynamics
D. Possible according to second law of thermodynamics

Ans. B

Sol: A perpetual motion machine is a hypothetical machine that can do work indefinitely without an energy source. This kind of machine is impossible, as it would violate the first or second law of thermodynamics.
Hence (B) is correct.

18. A system consisting of more than one phase is called _____.
A. Isolated system
B. Open system
C. Non-uniform system
D. Heterogeneous system

Ans. D

Sol: Heterogeneous system are referred to as phases.
Hence (D) is correct.

19. Thermal equilibrium between two or more bodies exists, when they are brought together, there is no change in _____.
A. Density
B. Pressure
C. Temperature
D. All options are correct

Ans. C

Sol: A system is said to be in thermal equilibrium with itself if the temperature within the system is spatially and temporally uniform.
Hence (C) is correct.

20. Control volume refers to a _____.
A. Specified mass
B. Fixed region in the space
C. Closed system
D. None of these

Ans. B

Sol: In an inertial frame of reference, it is a volume fixed in space or moving with constant flow velocity through which the continuum (gas, liquid or solid) flows. The surface enclosing the control volume is referred to as the control surface. The surface enclosing the control volume is referred to as the control surface.
Hence (B) is correct.

21. In regenerator type heat exchanger, heat transfer takes place by
A. direct mixing of hot and cold fluids
B. a complete separation between hot and cold fluids
C. flow of hot and cold fluids alternately over a surface
D. generation of heat again and again

Ans. C

Sol: Regenerator type of heat exchanger where heat from the hot fluid is intermittently stored in a thermal storage medium before it is transferred to the cold fluid.
Hence (C) is correct.

22. Film coefficient is the ratio of _____.
A. Thickness of film of fluid to thermal conductivity
B. Thickness of film of fluid to temperature drop through film of fluid
C. Thermal conductivity to temperature drop through film of fluid
D. Thermal conductivity to equivalent thickness of film of fluid

Ans. D

Sol: flow of heat by the material of pipe wall can be expressed as a heat transfer coefficient of the pipe wall or film coefficient.

$h=K/x$

h-film coefficient or heat transfer coefficient

K- Thermal conductivity

x- Thickness of film

Hence (D) is correct.

23. Highest thermal diffusivity is of _____.

A. Iron B. Lead

C. Concrete D. Wood

Ans. B

Sol: α- thermal infusibility

$\alpha(\text{Iron})=20.70\times10^{-6}$

$\alpha(\text{Lead})=23.43\times10^{-6}$

$\alpha(\text{Concrete})=9\times10^{-6}$

$\alpha(\text{Wood})=8.2\times10^{-8}$

Hence (B) is correct.

24. Highest thermal conductivity is of _____.

A. Solid ice B. Melting ice

C. Water D. Steam

Ans. A

Sol: K-Thermal conductivity

K(Solid ice) = 2.18

K(Melting ice) = 1.6(Around)

K(Water) = 0.63

K(Steam) =0.018

Hence (D) is correct.

25. The ratio of work done per cycle to the swept volume in case of compressor is called

A. compression index

B. compression ratio

C. compressor efficiency

D. mean effective pressure

Ans. D

Sol: $W=P\times V$

$P=W/V$

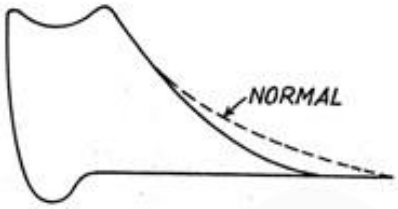
W- Work done per cycle

V- Swept volume

P-mean effective pressure

Hence (D) is correct.

26. The indicator diagram shown in the figure below obtained on a compressor shows that __.



A. suction valve or piston rings, or both are leaking

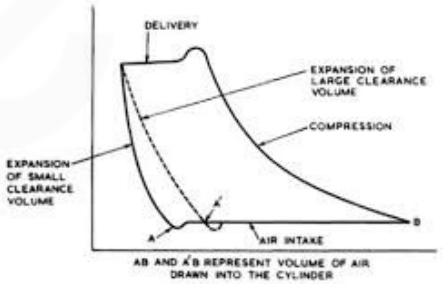
B. discharge valve is leaking into cylinder during compression stroke

C. slow opening suction valve

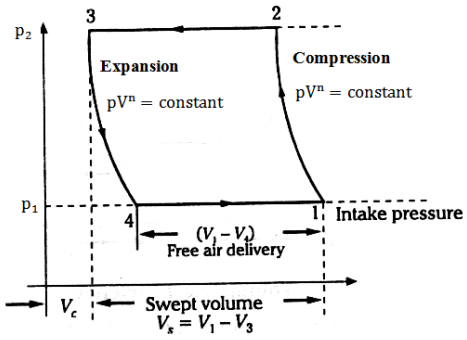
D. suction valve sticking open at beginning of compression stroke

Ans. B

Soln:



Compressor indicator diagram (courtesy Hamworthy Engineering Ltd)



from figure when the compressed air is delivered during the delivery stroke, some amount of air corresponding to clearance volumeV_3 at a pressure P_2 will be left over in the cylinder. During the next suction stroke this air expands back to initial pressure P_1 and volume V_4. Thus before the fresh air enters the cylinder some air corresponding to

volume V_4 will be already there in the cylinder. This the volume inhaled during the suction stroke will beV_1-V_4 which is less the swept volume V_S

The work done on the air delivered is not affected by the clearance volume as the work required to compress the clearance volume is theoretically regained during its expansion from V_3 to V4. So Ans B is correct

27. Metals are good heat conductors because _____.
    A. of free electrons present
    B. their atoms are relatively far apart
    C. their atoms collide frequently
    D. All options are correct

Ans. C

Soln: Metals are such good conductors of heat and electricity because the way they are molecularly bonded. The free electrons are able to move very freely. Since electricity and heat need electrons to move, the bonding promotes conductivity

28. Heat is transferred from an insulated pipe to the surrounding still air by _____.
    A. Conduction
    B. Convection
    C. Radiation
    D. All options are correct

Ans. C

Soln: The process by which heat is emitted from a body and transmitted across space as energy is called radiation. Heat radiation is a form of wave energy in space similar to radio and light waves. Radiation does not require any intermediate medium such as air for its transfer, it can readily take place across a vacuum.

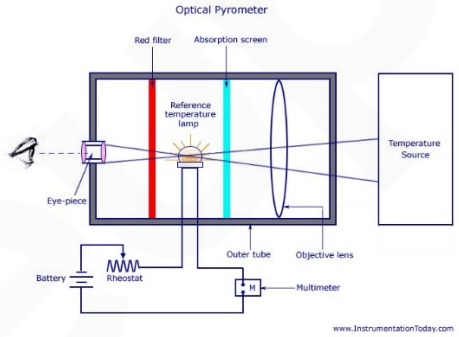
29. Heat is transferred by conduction, convection and radiation in _____.
    A. Boiler furnaces
    B. Melting of ice
    C. Condensation of steam in condenser
    D. None of these

Ans. A

Soln: A good example would be heating a tin can of water using a **Bunsen burner**. Initially the flame produces radiation which heats the tin can. The tin can then transfers heat to the water through conduction. The hot water then rises to the top, in the convection process.

30. In optical pyrometers absorption filter is used _____.
    A. To get monochromatic light
    B. To eliminate stray rays of light
    C. To minimise reflection of rays from the lens surface
    D. To enable filament operation at reduced intensity for longer life

Ans. D

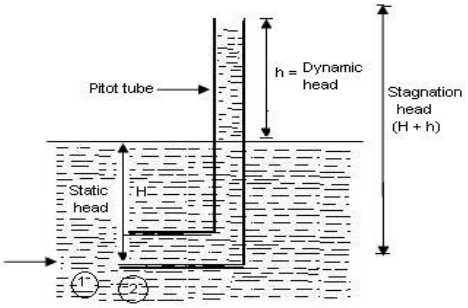


So Ans D is correct.

31. The flow of water in a pipe of diameter 3000 mm can be measured by _____.
    A. Venturimeter
    B. Rotameter
    C. Pilot tube
    D. Orifice plate

Ans. C

Sol: Pitot tube is device is use to measure the fluid flow velocity but A rotameter is a device that measures the volumetric flow rate of fluid in a closed tube.



Apply Bernoulli's theorem at 1 and 2

$P_1/\rho g + V_1^2/2g + Z_1 = P_2/\rho g + V_2^2/2g + Z_2$

$Z_1 = Z_2$ and $V_2^2/2g = 0$

$P_1/\rho g = H$ and $P_2/\rho g = h + H$

$H + V_1^2/2g = h + H$

$V_1 = \sqrt{2gh}$

32. Buoyant force is _____.
A. Resultant of up-thrust and gravity forces acting on the body
B. Resultant force on the body due to the fluid surrounding it
C. Resultant of static weight of body and dynamic thrust of fluid
D. Equal to the volume of liquid displaced by the body

Ans. D

Sol: The buoyant force comes from the pressure exerted on the object by the fluid. Because the pressure increases as the depth increases, the pressure on the bottom of an object is always larger than the force on the top - hence the net upward force. The buoyant force is present whether the object floats or sinks.

33. In equilibrium condition, fluids are not able to sustain _____.
A. Shear force
B. Resistance to viscosity
C. Surface tension
D. Geometric similitude

Ans. C

Sol: The cohesive forces between liquid molecules are responsible for the phenomenon known as surface tension. The molecules at the surface do not have other like molecules on all sides of them and consequently they cohere more strongly to those directly associated with them on the surface.

34. A large Reynold number is indication of _____.
A. Smooth and streamline flow
B. Laminar flow
C. Steady flow
D. Highly turbulent flow

Ans. D

Sol: turbulence can be predicted by a dimensionless constant called the Reynolds number, which calculates the balance between kinetic energy and viscous damping in a fluid flow.

35. 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

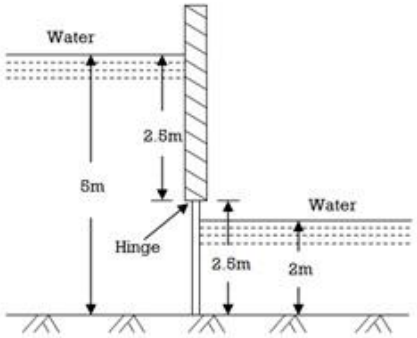
Sol. The Navier-Stokes equations govern the motion of fluids and can be seen as Newton's second law of motion for fluids it contains inertial forces, pressure forces, viscous forces, and the external forces applied to the fluid.

36. Tranquil flow must always occur _____.
A. at normal depth
B. above normal depth
C. below normal depth
D. above critical depth

Ans. D

Sol: the term 'Tranquil flow' as it applies to the area of reclamation can be defined as ' Distinguished from rapid flow by a dimensionless number called the Froude number. If the Froude number is less than one, the flow is tranquil.

37. A vertical sluice gate 3m wide and 2.5m deep contains water on both of its sides. On the upstream side, the water is 5m deep and on the downstream side it is 2m deep from the bottom of the sluice. What is the resultant pressure on the gate?



A. 275.9 KN
B. 58.9 KN
C. 217 KN
D. None of these

Ans. C

Sol: on the upper gate force act only in right direction which is equal to $\rho g\bar{h}A$
$= 1000\times9.81\times(2.5/2)\times2.5\times3$
$= 91.968KN$ (act on 3.75 from bottom)
On bottom gate two force act first in right and second in left direction
For right direction $F_r = \rho g\bar{h}A = 1000\times9.81\times(2.5 + 1.25)\ 2.5\times3 = 275.906KN$
For left direction $F_l = \rho g\bar{h}A = 1000\times9.81\times1\times6 = 58.86KN$
Resultant force on bottom gate = $F_r - F_l = 275.906 - 58.86 = 217.046KN$

38. The coefficient of discharge (Cd) of an orifice varies with _____.
A. Reynold number
B. Weber number
C. Froude number
D. Mach number

Ans. A

Sol: coefficient of discharge (Cd) of an orifice is define as ratio of actual discharge to theoretical discharge.
$Q_{act} = C_d\times Q_{th}$
And, $R_e = 4Q_{act}/\pi d_1\nu$where d1 and ν is pipe diameter and kinematics viscosity

39. Head loss in turbulent flow in a pipe _____.
A. Varies directly as velocity
B. Varies inversely as square of velocity
C. Varies approximately as square velocity
D. Varies inversely as velocity

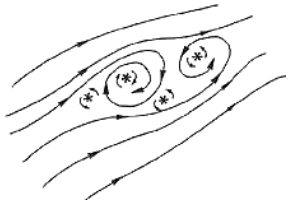
Ans. C

Sol: formula for head loss in pipe is
$H_l = fLV^2/2gd$

40. A type of flow in which the fluid particles while moving in the direction of flow rotate about their mass centre, is called _____.
A. Steady flow
B. Uniform flow
C. Laminar flow
D. Rotational flow

Ans. D

Sol: In fig. particles are flow in a fluid flow direction and also rotate about own axis



41. For a flow to be rotational, velocity normal to the plane of area should be equal to the __.
A. Angular velocity vector
B. Half the angular velocity vector
C. Twice the angular velocity vector
D. Zero

Ans. C

In a flow field, vorticity is related to fluid particle velocity which is defined as twice of rotation vector

$$\zeta = 2\vec{\omega} = \nabla\times\vec{V} = \left(\frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}\right)\hat{i} + \left(\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}\right)\hat{j} + \left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right)\hat{k}$$

42. A fluid in which resistance to deformation is independent of the shear stress, is called __.
A. Bingham plastic fluid
B. Pseudo plastic fluid
C. Dilatant fluid
D. Newtonian fluid

Ans. D

Sol: In Newtonian fluid, there is a linear relation between the magnitude of applied shear stress and the resulting rate of deformation

43. The rate of change of linear momentum is equals to _____.
A. Active force
B. Reactive force
C. Torque
D. Work done

Ans. A

Sol: This is Newton's Second Law of motion. According to this The rate of change of linear momentum
is directly proportional applied force where proportional constant is one.
$F \propto \frac{dmV}{dt}$
$F = ma$

44. The force buoyancy is dependent on _____.
A. Mass of liquid displaced
B. Viscosity of fluid
C. Surface tension of fluid
D. Depth of immersion

Ans. A

Sol: $F_B = \rho_f \times V_f \times g$

$M_f = \rho_f \times V_f$

Where M_f , ρ_f and V_f is the mass, density and volume of displaced liquid and F_B and g is buoyat force and acceleration due to gravity.

45. The vapour pressure over the concave surface is _____.
A. Less than the vapour pressure over the plane surface
B. Equal to vapour pressure over the plane surface
C. Greater than the vapour pressure over the plane
D. Zero

Ans. A

Sol: The Kelvin equation describes the change in vapour pressure due to a curved liquid–vapor interface, such as the surface of a droplet.

$$\ln \frac{P}{P_0} = \frac{2\gamma V_m}{rRT}$$

Where P is actual vapour pressure, P_0 is saturated vapour pressure, γ is surface tension, V_m is the molar volume of liquid, R is the universal gas constant, r radius of profile, T temperature.

46. Bernoulli's equation cannot be applied when the flow is _____.
A. Rotational
B. Turbulent
C. Unsteady
D. All options are correct

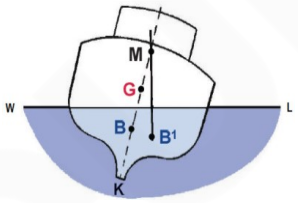
Ans. B

Sol: In turbulent flow particle of fluid does not move along streamline and collide with each other.

47. When a body floating in a liquid is displaced slightly, it oscillates about _____.
A. Centre of gravity of body
B. Centre of pressure
C. Centre of buoyancy
D. Metacentre

Ans. D

Sol: The point of intersection between an imaginary line drawn vertically through the centre of buoyancy of a floating vessel and a corresponding line through the new centre of buoyancy when the vessel is tilted.



48. Heaviest fluid is _____.
A. Air
B. Castor oil
C. Glycerin
D. Carbon tetrachloride

Ans. D

Sol: Density of Carbon tetrachloride is $1.59 g/cm^3$

Density of air is $0.001225 g/cm^3$

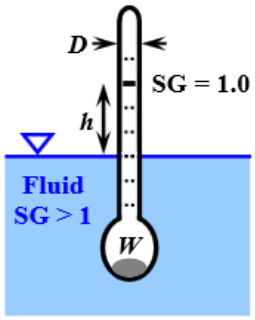
Density of castor oil is $0.961 g/cm^3$

Density of glycerin is $1.26 g/cm^3$

49. A hydrometer is used to determine _____.
A. Relative humidity
B. Buoyant force
C. Specific gravity of liquids
D. Viscosity of liquids

Ans. C

Sol: A hydrometer is usually made of glass, and consists of a cylindrical stem and a bulb weighted with mercury or lead shot to make it float upright. The liquid to test is poured into a tall container, often a graduated cylinder, and the hydrometer is gently lowered into the liquid until it floats freely. The point at which the surface of the liquid touches the stem of the hydrometer correlates to specific gravity.



50. A model of torpedo is tested in a towing tank at a velocity of 25 m/sec. The prototype is expected to attain a velocity of 5 m/sec. What model scale has been used?

A. 1 : 5 B. 1 : 2.5
C. 1 : 25 D. None of these

Ans. A

Sol: $V_{prototype}/V_{model} = 5/25 = 1/5$

51. For the water is flowing through a 20 cm diameter pipe with friction factor, f=0.04. The flow will be

A. Viscous
B. Non viscous
C. Both viscous and non-viscous
D. None of these

Ans. A

Sol. f = 64/Re
0.04 = 64/Re
Re = 1600
Laminar flow occurs at low Reynolds numbers, where viscous forces are dominant, and is characterized by smooth, constant fluid motion;
Hence flow is viscous.

52. Crude oil of kinematic viscosity 2.25 stokes flows through a 20 cm diameter pipe, The rate of flow being 1.5 litres/sec. The flow will be _____.

A. Laminar B. Turbulent
C. Uncertain D. None of these

Ans. A

Sol. In CGS system one cm^2/sec is equal to one stoke.
One stoke = 10^-4 m^2/sec

Velocity is given as

$$V = \frac{Q}{A} = \frac{4\times1.5\times10^{-3}}{\pi(0.2)^2}$$

$$V = 0.047\ m/s$$

Reynolds number is given as

$$Re = \frac{VD}{\nu} = \frac{0.047\times0.2}{2.25\times10^{-4}}$$

$$Re = 42.44$$

Hence as Re < 2000 flow is laminar.

53. The maximum continuous power available from a hydroelectric plant under the most adverse hydraulic conditions is known as _____.

A. base power B. firm power
C. primary power D. secondary power

Ans. B

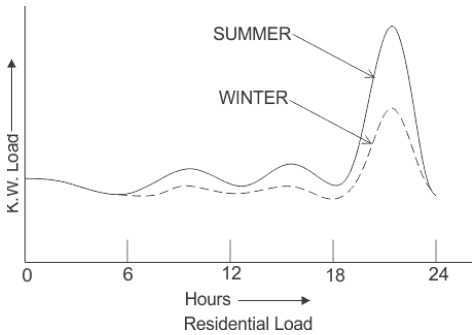
Sol. Firm energy also called as primary power refers to the actual energy guaranteed to be available.
Hence the answer is B

54. A plot between power generated in MW and time is known as _____.

A. Load curve
B. Load duration curve
C. Load factor
D. Demand curve

Ans. A

Sol. The load curve shows the variation of demand in specific time.



Hence the answer is A.

55. The ratio of 'Average generation in KWH per year' to 'the product of Installed capacity in KW and hrs per year' is known as _____.
A. Plant factor
B. Capacity factor
C. Use factor
A. only A B. A or B
C. A or B or C D. only C

Ans. C

Sol. The plant factor, also known as the net capacity factor, of a plant, is defined as the ratio of its actual energy output to its potential output.
The utilization factor or use factor is the ratio of the time that a piece of equipment is in use to the total time that it could be in use.
The capacity factor is the average power generated divided by the rated peak load.
Hence the answer is C

The capacity factor is the average power generated, divided by the rated peak power

56. Portion of the installed reserve kept is operable condition but not placed in service to supply the peak load is known as _____.
A. Operating reserve
B. Spinning reserve
C. Cold reserve
D. Hot reserve

Ans. C

Sol. Cold reserve in a power system is that reserve capacity which is available for service but normally not ready for immediate loading.
Hence the answer is C

57. Capacity of hydroelectric plant in service in excess of the peak load is known as _____.
A. Operating reserve
B. Spinning reserve
C. Cold reserve
D. Hot reserve

Ans. A

Sol. Operating reserve is the generating capacity available to the system operator within a short interval of time to meet demand in case a generator goes down or there is another disruption to the supply.
Hence the answer is A

58. An impulse turbine is used for _____.
A. Low head of water
B. High head of water
C. Medium head of water
D. High discharge

Ans. B

Sol. In impulse turbines the fluid flows with high velocity through nozzle, which changes the direction of flow of fluid. The rotation of turbine shaft is due to change in momentum of a fluid over curved rotor blades. For the fluid to attain high velocity a high head of water is required.
Hence correct answer is B.

59. In a reaction turbine, the draft tube is used _____.
A. To run the turbine full
B. To prevent air to enter the turbine
C. To increase the effective head of water
D. To transport water to downstream

Ans. C

Sol. The primary function of the draft tube is to reduce the velocity of the discharged water to minimize the loss of kinetic energy at the outlet.
Hence the answer is C.

60. In an inward flow reaction turbine _____.
A. The water flows parallel to the axis of the wheel
B. The water enters the center of wheel and there flows towards the outer periphery of the wheel
C. The water enters the wheel at the outer periphery, and then flows towards the centre of the wheel
D. The flow of water is partly radial and partly axial

Ans. C

Sol. In Inward flow reaction hydro turbine water enter at the outer periphery, flow inward and toward the center of the turbine and discharges at the outer periphery.
Hence the correct answer is C.

61. Castor and camber are terms associated with which of the following parts of an automobile?
A. Gears B. Engine
C. Suspension D. Wheels

Ans. D

Sol. Caster also known as castor is a wheeled device being housed to objects for easy movement of objects through rolling movement of these wheels.
Camber refers to various curvature and angles.
Hence the correct answer is D.

62. In reciprocating engines primary forces _____.
A. Are completely balanced
B. Are partially balanced
C. Are balanced by secondary forces
D. Cannot be balanced

Ans. B

Sol. In reciprocating engines under primary forces couples are not balanced.
Hence answer is B

63. A friction circle is a circle drawn when the journal rotates in a bearing. Its radius depends on the coefficient of friction and _____.
A. Magnitude of the forces on the journal
B. Angular velocity of the journal
C. Clearance between the journal and the bearing
D. Radius of the journal

Ans. D

Sol: Friction circle radius,

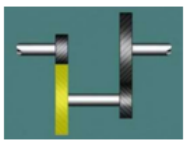
$$r_f = r\sin\phi_s \approx r\mu_S$$

Hence option D is correct

64. The gear train usually employed in clocks is a _____.
A. Reverted gear train
B. Simple gear train
C. Sun and planet gear
D. Differential gear

Ans. A

Sol.



In a reverted gear train, the first and the last gears have the same axis of rotation.

65. Critical damping is a function of _____.
A. Mass and stiffness
B. Mass and damping co-efficient
C. Stiffness and natural frequency
D. Natural frequency and damping co-efficient

Ans. A

Sol. Critical damping: The system returns to equilibrium as quickly as possible without oscillating.
It depends on mass and stiffness.
Hence the answer is A.

66. Rotating shafts tend to of vibrate violently at whirling speeds because ____.
A. The shafts are rotating at vary speeds
B. Bearing centre line coincide with the shaft axis
C. The system is unbalanced
D. Resonance is caused due to the heavy weight of the rotor

Ans. D

Sol. Critical or whirling speed is the speed at which violent vibration occurs in shaft in transverse direction when the shaft rotates in horizontal direction or when the shaft is in resonance due to mass of shaft.
Hence the answer is D

67. Critical or whirling speed is the speed at which the shaft tends to vibrate violently in __.
A. Transverse direction
B. Longitudinal direction
C. Linear direction
D. None of these

Ans. A

Sol. Critical or whirling speed is the speed at which violent vibration occurs in shaft in transverse direction when the shaft rotates in horizontal direction or when the shaft is in resonance.
Hence the answer is A

68. When a shaking force is transmitted through the springs, damping becomes detrimental when the ratio of its frequency to the natural frequency is greater than _____.
A. 0.25 B. 0.5
C. 1 D. $\sqrt{2}$

Ans. D

Sol: When $\omega/\omega_n > \sqrt{2}$, the transmitted force is always less than the impressed force. it alsoimplies that TR decreases with decreasing values of ζ. Thus, an undamped spring is superior to a damped spring in reducing force transmissibility. These conditions will be satisfied by materials like steel springs, rubber, cork, felt etc., which are generally used as vibration isolators.

69. Stress concentration in static loading is more serious in _____.
A. Ductile materials
B. Brittle materials
C. Equally serious in both cases
D. Depends on other factors

Ans. B

Sol. Stress concentration is more serious in brittle material because stress concentration in brittle material results in immediate failure while ductile materials neutralize effect of stress concentration to some extent by deforming plastically
Hence the answer is B

70. Which of the following key transmits power through frictional resistance only?
A. Saddle key B. Barth key
C. Kennedy key D. Tangent key

Ans. A

Sol. Saddle key is used for securing a member to a machine shaft that fits into a keyway in the secured member and is concave to grip the shaft by friction.
Hence the answer is A.

71. The key will fail in which of the following manner?
A. Shearing
B. Crushing
C. Both crushing and shearing
D. None of these

Ans. C

Sol. Shear failure: Actually, during rotation the shaft and the machine element, say hub, each element exerts equal and opposite force on the key.
Crushing: During rotation the shaft and the hub impose compressive force on the key causing its deformation. The key is then permanently deformed under this force and finally crushing occurs.
Hence the answer is C

72. In hydrostatic bearing the starting friction is _____.
A. Very low
B. More
C. Either more or less
D. Uncertain

Ans. A

Sol. Fluid bearings generally have low friction than mechanical bearings.
Hence the answer is A

73. Feather keys are generally _____.
A. Tight in shaft and loose in hub
B. Loose in shaft and tight in hub
C. Tight in both shaft and hub
D. Loose in both shaft and hub

Ans. A

Sol. The mating slot in the shaft is machined with an end mill that matches the radius of the shaft key design.
Hence the answer is A

74. The uniform pressure theory as compared to the uniform wear theory gives _____.
A. Higher frictional torque
B. Lower frictional torque
C. Either lower or higher frictional torque
D. None of these

Ans. A

Sol. The torque equation for uniform pressure theory is

$$T_c = \frac{2}{3} n \pi \mu p (r_o^3 - r_i^3)$$

The torque equation for uniform wear theory is

$$T_c = \pi \mu p_{max} r_i (r_o^2 - r_i^2)$$

Comparing the torque equations we notice high torque capacity for uniform pressure theory.
Hence correct answer is A

75. Tapered roller bearings can take _____.
A. Radial load only
B. Axial load only
C. Both radial and axial loads and the ratio of these being less than unity
D. Both radial and axial loads and the ratio of these bring greater than unity

Ans. C

Sol. Tapered roller bearings have tapered inner and outer ring raceways as well as tapered rollers. They are designed to accommodate combined loads, i.e. simultaneously acting radial and axial loads.
Hence answer is C

76. Two shafts A and B are made of the same material. The diameter of shaft B is twice that of shaft A. The ratio of power which can be transmitted by shaft A to that of shaft B is ____.
A. 1/2 B. 1/4
C. 1/8 D. 1/16

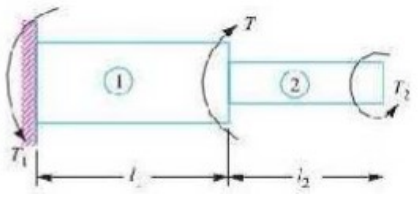
Ans. C

Sol: $P \propto D^3$
$P_A/P_B = (D_A)^3/(D_B)^3 = (D_A)^3/(2D_A)^3 = 1/8$

77. For the two shafts connected in parallel, find which statement is true?
A. Torque in each shaft is the same
B. Shear stress in each shaft is the same
C. Angle of twist of each shaft is the same
D. Torsional stiffness of each shaft is the same

Ans. C

Sol: When the driving torque (T) is applied at the junction of the two shafts, and the resisting torques T1 and T2 at the other ends of the shafts, then the shafts are said to be connected in parallel.



In such cases, the angle of twist is same for both the shafts
$\Theta_1 = \Theta_2$
$T_1L_1/J_1G_1 = T_2L_2/J_2G_2$

78. The buckling load will be maximum for a column if _____.
A. One end of the column is clamped and the other end is free
B. Both ends of the column are clamped
C. Both ends of the column are hinged
D. One end of the column is hinged and other end is free

Ans. B

Sol: Both end is hinged = π^2EI/L^2
One end fixed and other free = $\pi^2EI/4L^2$
Both end free = $4\pi^2EI/L^2$
One end is fixed and other is hinged = $2\pi^2EI/L^2$

79. The number of strain readings (using strain gauges) needed on a plane surface to determine the principal strains and their directions are _____.
A. 1 B. 2
C. 3 D. 4

Ans. C

Sol: Maximum and minimum normal strain possible for a specific point on a structural element. Shear strain is 0 at the orientation where principal strain occurs. 3 strain gauges needed on a plane surface to determine the principal strains and their directions.

80. If the value of Poisson's ratio is zero, then it means that _____.
A. The material is rigid
B. The material is perfectly plastic
C. There is no longitudinal strain in the material
D. None of these

Ans. D

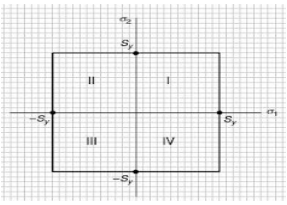
Sol: the ratio of the proportional decrease in a lateral measurement to the proportional increase in length in a sample of material that is elastically stretched.

81. Which of the following is applied to brittle materials?
A. Maximum principal stress theory
B. Maximum principal strain theory
C. Maximum strain energy theory
D. Maximum shear stress theory

Ans. A

Sol: According to this theory when the maximum principal stress induced in a material under complex load condition exceeds the maximum normal strength in a simple tension test the material fails.

$$\sigma_1 \geq \sigma_{ult}$$



82. Design of shafts made of brittle materials is based on _____.
A. Guest's theory
B. Rankine's theory
C. St. Venant's theory
D. Von Mises theory

Ans. B

Sol: Rankine's theory is also called Maximum principal stress theory.

83. The moment of inertia of a hollow circular section whose external diameter is 8 cm and internal diameter is 6 cm about centroidal axis is _____ cm4.
A. 437.5 B. 337.5
C. 237.5 D. 137.5

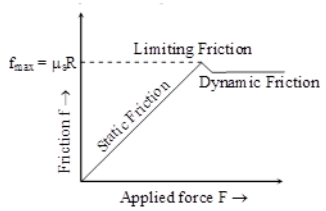
Ans. A/D

Sol: $I = \pi D^4/64 - \pi d^4/64$
$= (\pi/64)[8^4 - 6^4]$
$= 137.5cm^4$

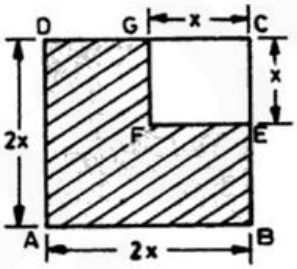
84. The maximum frictional force which comes into play when a body just begins to slide over the surface of another body is known as _____.
A. sliding friction
B. rolling friction
C. limiting friction
D. None of these

Ans. C

Sol:



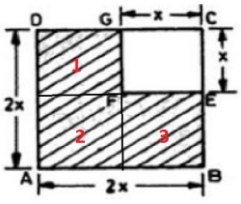
85. A square sheet of metal has a square of one quarter of the original area cut from one corner as shown in the figure. Which of the following statements is true about the position of the centre of gravity of the remaining portion of the sheet?



A. Centre of gravity lies at a distance of 5/12 of the side of the original square form each uncut side
B. Centre of gravity lies at a distance of 7/12 of the side of the original square from each uncut side
C. Centre of gravity lies at a distance of 3/4 of the side of the original square from each uncut side
D. None of these

Ans. A

Sol:



Area name	Area (A)	Centre of gravity in x direction (x_i)	A_ix_i
1	X^2	x/2	$X^3/2$
2	X^2	x/2	$X^3/2$
3	X^2	3x/2	$3X^3/2$
Toal=1+2+3	$3\ X^2$		$5X^3/2$

$\bar{x} = A_i x_i / A = (5X^3/2)/(3X^2) = 5x/6$

x = 1/2 of side

$\bar{x}$ = 5/12 of side

Similar for y direction

86. A steel bar 20 mm in diameter simply supported at its ends over a total span of 40 cm, carries a load at its center. If the maximum stress included in the bar is limited to $480/\pi$ N/mm2 then the bending strain energy stored in the bar is _____.

A. 411 N mm B. 511 N mm
C. 611 N mm D. 711 N mm

Ans. C

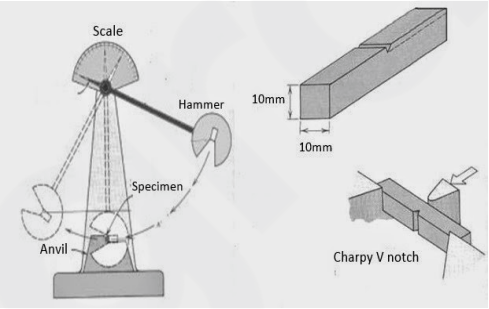
Strain Energy= $\frac{\sigma 2}{2E} \times Volume = \frac{(480/\pi)^2}{420\times1000} \times \frac{\pi}{4} \times 400 \times 400$ =----------some Data Missing.

87. The Charpy test is conducted to measure _____.

A. Toughness
B. Creep strength
C. Fatigue strength
D. Elastic strength of a material

Ans. A

Sol: The Charpy impact test is determines the amount of energy absorbed by a material during fracturethat is toughness.



88. The stress produced by a suddenly applied load as compared to that produced by the same load when applied gradually is _____ times.

A. 1.5 B. 2
C. 3 D. 4

Ans. B

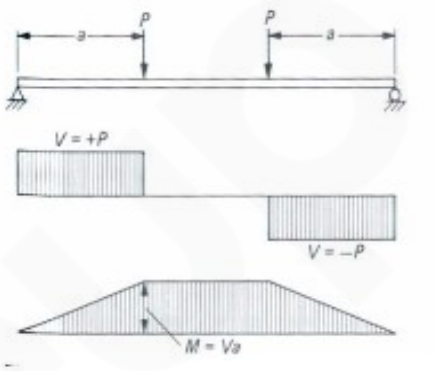
Sol: sudden force is always twice of graduallyapplied force of same amount.

89. The bending moment for a certain portion of the beam is constant. For that section, shear force would be _____.

A. Zero B. Increasing
C. Decreasing D. Constant

Ans. A

Sol: In fig. for case of pure bending shear force is zero



90. An increase in load at the free end of a cantilever is likely to cause failure _____.

A. At the free end
B. At the mid of its length
C. At the fixed support end
D. Anywhere on the beam

Ans. C

Sol: bending moment will be more at fixed support.

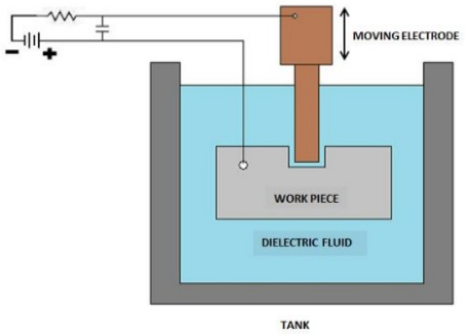
91. In the electro-discharge machining process, the work-piece and the electrode are submerged in _____.

A. a dielectric fluid
B. an abrasive slurry
C. an electrolytic solution
D. vacuum

Ans. A

Sol: lectrical discharge machining , also known as spark machining, spark eroding, burning, die sinking, wire burning or wire erosion, is a manufacturing process whereby a desired shape is obtained by using electrical discharges (sparks).[1] Material is removed from the workpiece by a series of rapidly recurring current discharges between two electrodes,

separated by a dielectric liquid and subject to an electric voltage.



92. Swaging is an operation of _____.
A. hot rolling B. forging
C. extrusion D. piercing

Ans. B

Sol: Swaging is a forging process in which the dimensions of an item are altered using dies into which the item is forced. Swaging is usually a cold working process, but also may be hot worked.

93. In arc welding operations the current value is decided by _____.
A. thickness of plate
B. length of welded portion
C. voltage across the arc
D. size of the electrode

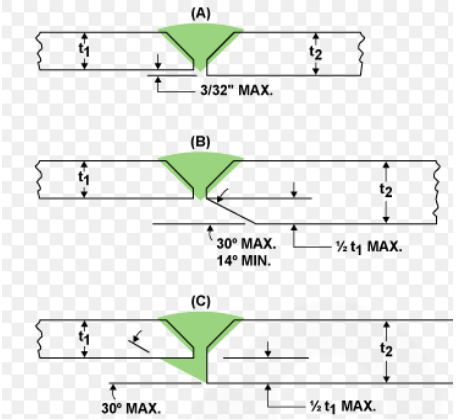
Ans. D

Sol: current value is increase with size of the electrode. The smaller the diameter means it requires less current and it deposits a smaller amount of filler metal.

94. Two sheets of same material but different thickness can be butt welded by _____.
A. adjustment of the current
B. time duration of current
C. pressure applied
D. changing the size of one electrode

Ans. D

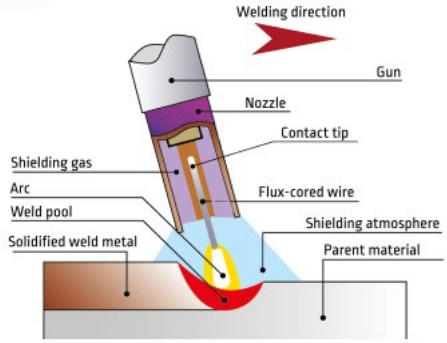
Sol: changing the size of one electrode is needed because both the thickness of weld is not same.



95. Pick up the incorrect statement about MIG welding.
A. no flux required
B. high welding speed
C. increased corrosion resistance
D. even unclean surface can be welded to obtain sound welds

Ans. A

Sol: MIG welding stands for Metal Inert Gas welding in which flux are also use.



96. First product of the blast furnace in the process of converting iron ore into useful metal by reduction is called _____.
A. Cast iron B. Wrought iron
C. Pig iron D. Steel

Ans. C

Sol: Pig iron is Semi-finished metal produced from iron ore in blast furnace, containing 92 percent iron, high amounts of carbon , and balance largely manganese and silicone plus small amounts of phosphorus, sulfur, and other impurities. Pig iron is further refined in a furnace for conversion into steel.

97. Raw material for all iron and steel product is _____.
A. Cast iron B. Wrought iron
C. Pig iron D. Steel
Ans. C
Sol: Pig iron cannot be used the way it is since the end material is still unstable and very brittle. To make use of pig iron or convert into steel product, it is still necessary to refine it

98. Grey cast iron has _____.
A. brittleness
B. low electrical conductivity
C. low compressive strength
D. All options are correct
Ans. B
Sol: All grey irons will have higher electrical resistivities compared to steels. Grey irons with coarse graphites in their structures have higher resistivities compared to those with finer graphites.

99. Chilled cast iron is _____.
A. Soft on surface
B. Machined freely
C. High resistance to wear
D. All options are correct
Ans. C
Sol: chilled-iron castings are made by casting the molten metal against a metal chiller, resulting in a surface of white cast iron. Chilled cast iron belongs to a group of metals possessing high strength, high hardness, high toughness and high wear resistance.

100. If carbon present in cast iron is partly free and partly in combined state, it is called ____.
A. White cast iron B. Grey cast iron
C. Molten cast iron D. None of these
Ans. A
Sol: The carbon in grey cast iron is just mixed in amongst the iron molecules; in white cast iron, the iron and carbon are actually combined. "Combination" implies the two substances -- in this case, carbon and iron -- have chemically bonded together.
White cast iron contains 1.8% -3.6% C, 0.5% -1.9% Si and 1% – 2 % manganese (Mn). White cast irons are so called because when broken, the fracture surface is white.