# ISRO VSSC TA 2017

**Q1. If the resultant of two forces P and Q acting at an angle θ makes an angle α with the force P, then**

(a) $\tan\alpha = \frac{P\sin\theta}{P + Q\cos\theta}$

(b) $\tan\alpha = \frac{P\cos\theta}{P + Q\cos\theta}$

(c) $\tan\alpha = \frac{Q\sin\theta}{P + Q\cos\theta}$

(d) $\tan\alpha = \frac{Q\cos\theta}{P + Q\sin\theta}$

**Q2. Positive displacement flow meters are ..... flow meters.**

(a) Variable area flow

(b) Differential pressure flow

(c) Quantity flow

(d) None of these

**Q3. A vertical column has two moments of inertia $I_{xx}$ and $I_{yy}$, The column will tend to buckle in the direction of the**

(a) axis of load

(b) perpendicular to the axis of load

(c) maximum moment of inertia

(d) minimum moment of inertia

**Q4. Two bodies with moment of inertia $I_1$ and $I_2$ ($I_1 > I_2$) have equal angular momentum. If Kinetic Energy of rotation are $E_1$ and $E_2$ then**

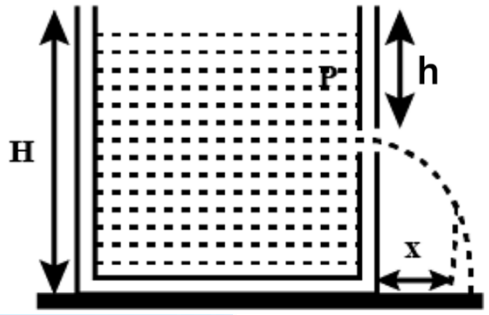
(a) $E_1 < E_2$

(b) $E_1 > E_2$

(c) $E_1 = E_2$

(d) $E_1 \geq E_2$

**Q5. A tank is filled with water up to a height H. Water is allowed to come of a hole P in one of the walls at a depth 'h' below the surface of water. Express the horizontal distance x in terms of H and h**




(a) $x = \sqrt{H}(H\text{-}h)$

(b) $x = \sqrt{\left[\frac{H(H-h)}{2}\right]}$

(c) $x = 2\sqrt{H}(H\text{-}h)$

(d) $x = 4\sqrt{H}(H\text{-}h)$

**Q6. Ball bearings are generally made of**

(a) Cast Iron

(b) Aluminium

(c) Chrome steel

(d) None of the above

**Q7. Charpy test is conducted to measure**

(a) Hardness

(b) Malleability

(c) Brittleness

(d) Machinability

**Q8. The most efficient section of a flow channel is**

(a) Circular

(b) Rectangular

(c) Square

(d) Trapezoidal

**Q9. Reynolds's number is the ratio of the inertia force to the**

(a) surface tension force

(b) viscous force

(c) gravity force

(d) pressure force

**Q10. The thermal offered by a rectangular wall of thermal conductivity k, thickness t and cross sectional area A (assume no heat generation) is given by:**
(a) t/(k/A)
(b) (kA)/t
(c) (kt)/A
(d) (At)/k

**Q11. Which of the following theories is related to the theory of the thermocouple?**
(a) Piezoelectric effect
(b) Seeback effect
(c) Skin effect
(d) Faraday's Law

**Q12. Emissivity of a black body is:**
(a) 1
(b) 0
(c) infinite
(d) Cannot be determined

**Q13. Bernoulli's equation is the statement about fluid flow for**
(a) Conservation of mass
(b) Conservation of momentum
(c) Force balance
(d) Conservation of energy

**Q14. In the case of perfectly elastic collision, the coefficient of restitution is**
(a) 1.0
(b) 0.5
(c) Less than 1.0
(d) Zero

**Q15. A liquid flows in the tube from left to right as shown in figure. A1 and A2 are the cross-sections of the portions of the tube as shown. Then the ratio of speeds v1/v2 will be**
(a) $\frac{A_1}{A_2}$
(b) $\frac{A_2}{A_1}$
(c) $\frac{\sqrt{A_2}}{\sqrt{A_1}}$
(d) $\frac{\sqrt{A_1}}{\sqrt{A_2}}$

**Q16. A spherical black body of radius r radiates power P, and its rate of cooling is R, then**
(a) $P \alpha r^2$
(b) $P \alpha r$
(c) $R \alpha r^2$
(d) $R \alpha 1/r$

**Q17. Which of the following metal has the lowest melting point?**
(a) Antimony
(b) Tin
(c) Silver
(d) Zinc

**Q18. This material is used for producing laser**
(a) Graphite
(b) Ruby
(c) Diamond
(d) Emerald

**Q19. A steel rod of length L and diameter D, fixed at both ends, is uniformly heated to a temperature rise of $\Delta T$. The Young's modulus is E and the coefficient of linear expansion is $\alpha$. The thermal stress in the rod is**
(a) 0
(b) $\alpha$
(c) $E\alpha\Delta T$
(d) $E\alpha\Delta TL$

**Q20. Torsion in a shaft produces**
(a) Tensile stress
(b) Compressive stress
(c) Shear stress
(d) Bending

**Q21. What is the percentage increase in tool life when the cutting speed is halved?**
(a) 300%
(b) 400%
(c) 5%
(d) 200%

**Q22. Ring rolling is used**
(a) For producing seamless tubes
(b) To increase thickness of a ring
(c) To decrease thickness of a ring
(d) For producing large cylinder

**Q23. A rod of length L and diameter D is subjected to a tensile load P. Which of the following is sufficient to calculate the resulting change in diameter?**
(a) Young's modulus
(b) Shear modulus
(c) Poisson's ratio
(d) Both a and b

**Q24. A cantilever beam of length L is subjected to a moment M at the free end. The moment of inertia of the beam cross section about the neutral axis is 1 and the Young's modulus is E. The magnitude of the maximum deflection is**
(a) $\frac{ML^2}{2EI}$
(b) $\frac{ML^2}{EI}$
(c) $\frac{2ML^2}{2EI}$
(d) $\frac{4ML^2}{2EI}$

**Q25. The locus of a point on a string unwound from a circular disc is**
(a) A circle
(b) A cycloid
(c) An involute
(d) A parabola

**Q26. In a state of stress, principal planes are planes of**
(a) Zero normal stress
(b) Zero shear stress
(c) Equal normal and shear stresses
(d) Maximum shear stress

**Q27. The generalized Hook's law is applicable up to**
(a) Yield point
(b) Braking point
(c) Linear elastic point
(d) Plastic Limit

**Q28. A column has a rectangular cross-section of 10*20mm and a length of 1m. The slenderness ratio of the column is close to**
(a) 200
(b) 346
(c) 477
(d) 1000

**Q29. For a stability of a floating body, under the influence of gravity alone, which of the following is TRUE?**
(a) Metacentre should be below centre of gravity.
(b) Metacentre should be above centre of gravity.
(c) Metacentre and centre of gravity must lie on the same horizontal line.
(d) Metacentre should be at canter of gravity.

**Q30. A body falls freely from rest from the top of a tall cliff. The distance it travelled in the first second is**
(a) 9.8 m
(b) 10 m
(c) 4.9 m
(d) 1 m

**Q31. Which of the following does not change during throttling process**
(a) Internal energy

(b) Pressure
(c) Entropy
(d) Enthalpy

**Q32. In an automobile car where is the Hook's joint used?**
(a) Between clutch and gear box
(b) Between differential gear and wheels
(c) Flywheel and clutch
(d) Between gear box and propeller shaft

**Q33. The condition for self-locking in screw is ($\mu$ = coefficient of friction, $\alpha$ = helix angle)**
(a) $\mu \geq \text{Tan}\alpha$
(b) $\mu \leq \text{Tan}\alpha$
(c) $\mu = \alpha$
(d) $\mu \geq \alpha$

**Q34. The pressure within the cylinder of hydraulic press is 9MPa. The inside diameter of the cylinder is 500mm. If the permissible tensile stress is 10N/mm$^2$, the minimum wall thickness of the cylinder is**
(a) 12.5 mm
(b) 16 mm
(c) 9 mm
(d) 18 mm

**Q35. In a close-coiled helical spring subjected to an axial load other quantities remaining the same, if the wire diameter is doubled, then the stiffness of the spring when compared to the original one will become:**
(a) Twice
(b) Four times
(c) Eight times
(d) Sixteen times

**Q36. A bullet is fired to get maximum range. The angle at which it is to be fired (neglecting drag in air) with respect to the horizontal is:**
(a) $\theta = 90°$
(b) $\theta = 30°$
(c) $\theta = 60°$
(d) $\theta = 45°$

**Q37. Bending moment at a hinge is:**
(a) 0
(b) Maximum
(c) Minimum
(d) Depends on the loading

**Q38. A hydraulic turbine develops 1000kW power for a head of 40m. If the head is reduced to 20m, the power developed (in kW) is**
(a) 177
(b) 354
(c) 500
(d) 707

**Q39. The most appropriate failure theory for the ductile materials is**
(a) Maximum principle theory
(b) Maximum shear stress theory
(c) Maximum principal strain theory
(d) Maximum shear strain energy theory

**Q40. A Gantt chart provides information about**
(a) Material handling
(b) Production schedule
(c) Proper utilization of man power
(d) All of the above

**Q41. In 18-4-1 HSS, what is the percentage of chromium?**
(a) 1%
(b) 4%
(c) 18%
(d) None of the above

**Q42. A satellite of mass 1000kg orbits around the earth at an altitude of 100km, will experience a weight of**

(a) 1000 kgf
(b) Zero
(c) 750 kgf
(d) 9800 kgf

**Q43. Presence of Hydrogen in steel results in:**
(a) Corrosion resistance
(b) Improved weldability
(c) No effect on steel due to small size of hydrogen atom
(d) Embrittlement

**Q44. For a Newtonian fluid**
(a) Shear stress is proportional to shear strain
(b) Rate of shear stress is proportional to shear strain
(c) Shear stress is proportional to rate of shear strain
(d) Rate of shear stress is proportional to rate of shear strain

**Q45. Two bodies m1 and m2 (m1>m2) have the same kinetic energy. Then their momentum P1 and P2 satisfy**
(a) P1 = P2
(b) P1 > P2
(c) P1 < P2
(d) P1 = -P2

**Q46. Double hemispherical buckets are used in**
(a) Kaplan turbine
(b) Francis turbine
(c) Propeller turbine
(d) Pelton turbine

**Q47. To find fits on hole basis system**
(a) Shaft is kept constant and hole size is changed
(b) Hole is kept constant and shaft size is changed
(c) Upper deviation of shaft is zero
(d) Lower limit of hole is not same as basic size

**Q48. Maximum power transmission in a belt is met when the total tension in the belt equals**
(a) centrifugal tension
(b) $2\pi$ times centrifugal tension
(c) Thrice centrifugal tension
(d) Half the centrifugal tension

**Q49. Within the HAZ in fusion welding, the material undergoes:**
(a) Microstructure changes however, material will not melt.
(b) Neither melting not microstructure changes since the temperature at HAZ is less than the upper critical temperature.
(c) Both melting and microstructure changes
(d) Material melts however, after solidification, original microstructure is retained

**Q50. Babbit is an alloy of**
(a) Sn and Cu
(b) Cu and Zn
(c) Sn, Cu, Sb and Pb
(d) Sn, Cu and Pb

**Q51. Two 1mm thick steel sheets are to be spot welded at a current of 5000A. Assuming effective resistance to be 200 micro-ohms and current flow time of 0.2 second, heat generated during the process is**
(a) 0.2 Joule
(b) 1 Joule
(c) 5 Joule
(d) 1000 Joule

**Q52. In stroboscopic measurement, a flywheel having a mark on the rim was seen as two marks at 100Hz signal, its rotational speed is**

(a) 100 rpm
(b) 6000 rpm
(c) 3000 rpm
(d) 1.67 rpm

**Q53. Surface tension has the units of:**
(a) Force
(b) Force per unit length
(c) Force per unit Area
(d) Force per unit volume

**Q54. Two metal strips that constitute a thermostat must necessarily differ in their**
(a) Mass
(b) Length
(c) Resistivity
(d) Coefficient of linear expansion

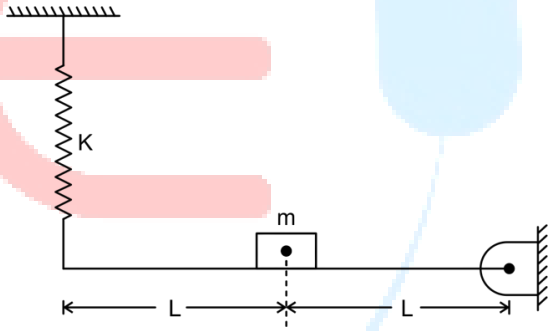
**Q55. If two metallic plates of equal thickness and thermal conductivities K1 and K2 are put together face to face and a common plate is constructed, then the equivalent thermal conductivity of this plate will be**
(a) $\frac{K_1K_2}{K_1+K_2}$
(b) $\frac{2K_1K_2}{K_1+K_2}$
(c) $\frac{(K_1^2+K_2^2)^{3/2}}{K_1K_2}$
(d) $\frac{(K_1^2+K_2^2)^{3/2}}{2K_1K_2}$

**Q56. In order to have interference fit, it is essential that the lower limit of the shaft should be**
(a) Greater than the upper limit of the hole
(b) Lesser than the upper limit of the hole
(c) Greater than the lower limit of hole
(d) Lesser than the lower limit of the hole

**Q57. A condenser of refrigeration system rejects heat at rate of 120kW, while its compressor consumes power of 30kW, The COP of the system is**
(a) 4
(b) 1/4
(c) 3
(d) 1/3

**Q58. The height to which a liquid will rise in an open capillary tube is inversely proportional to**
(a) Temperature of liquid
(b) Density of liquid
(c) Air pressure
(d) Surface tension

**Q59. A concentrated mass m is attached at the centre of a rod of length 2L as shown in the figure. The rod is kept in a horizontal equilibrium position by a spring of stiffness k. For very small amplitude of vibration, neglecting the weights of the rod and spring, the undamped natural frequency of the system is**




(a) $\sqrt{\frac{K}{M}}$
(b) $\sqrt{\frac{2k}{M}}$
(c) $\sqrt{\frac{K}{2m}}$
(d) $\sqrt{\frac{4k}{M}}$

**Q60. Dew point temperature is the temperature at which condensation starts when air is cooled at constant:**
(a) Volume

(b) Pressure
(c) Enthalpy
(d) None of the above

**Q61. If a closed system is undergoing an irreversible process, the entropy of the system**
(a) must increase
(b) always remains constant
(c) must decrease
(d) can increase , decrease or remain constant

**Q62. Which of the following welding uses non consumable electrodes**
(a) SAW
(b) MIG
(c) GTAW
(d) Thermit

**Q63. What type of lubricant is graphite**
(a) Solid
(b) Liquid
(c) Semi solidσ
(d) None of the above

**Q64. Friction at the tool-chip interface can be reduced by**
(a) Decreasing the rake angle
(b) Increasing the depth of cut
(c) Decreasing the cutting speed
(d) Increasing the cutting speed

**Q65. The potential energy of a particle executing SHM varies sinusoidally. If the frequency of oscillation of particle is n. That of potential energy is**
(a) n/2
(b) $n/\sqrt{2}$
(c) n
(d) 2n

**Q66. The state of stress at a point under plane stress condition is $\sigma_{xx}$ = 40MPa, $\sigma_{yy}$ = 100MPa and $\tau_{xy}$ = 40MPa. The radius of the Mohr's circle representing the given state of stress in MPa is**
(a) 40
(b) 50
(c) 60
(d) 100

**Q67. The stress due to unit strain is**
(a) Modulus of elasticity
(b) Modulus of rigidity
(c) Principal stress
(d) Normal stress

**Q68. The CLA value is used for the measurement of**
(a) Surface flatness
(b) Hardness
(c) Surface roughness
(d) Internal voids

**Q69. If an unconstrained steel bar is heated uniformly, there develops**
(a) Thermal stress
(b) Shear stress
(c) Tensile stress
(d) No stress

**Q70. In a cantilever beam with point load at its free end, the maximum bending moment occur at**
(a) Centre of the beam
(b) Free end of the beam
(c) Fixed end of the beam
(d) At the point of application of the load

**Q71. Which mechanism produces mathematically exact straight line motion**
(a) Watt's mechanism
(b) Peaucellier mechanism
(c) Ackermann mechanism
(d) Grasshopper mechanism

**Q72. A vibrating system is said to be critically damped when the damping factor is**
(a) Zero
(b) Unity
(c) 1/2
(d) Infinity

**Q73. The pressure P of an ideal gas and its mean kinetic energy E per unit volume are related as**
(a) P = E/2
(b) P = E
(c) P = 3E/2
(d) P = 2E/3

**Q74. Pascal's law states that the pressure at a point is equal in all directions for:**
(a) Confined compressible fluid
(b) Confined Incompressible fluid
(c) Fluid having laminar /Viscous flow
(d) All fluids

**Q75. Two coins are tossed simultaneously. Find the probability of getting at least one tail?**
(a) 1/4
(b) 3/4
(c) 4/3
(d) 1/2

**Q76. If x% of 450 is 67.5, the value of x is**
(a) 15
(b) 25
(c) 85
(d) 50

**Q77. The sixth term in the expansion of $(x + 1/x)^{10}$ is ?**
(a) 250
(b) 252
(c) $10C_6$
(d) $10C_7$

**Q78. An aeroplane starts from a place and flies $10\sqrt{2}$M in a straight line, at 45° to the horizontal. Find the horizontal distance covered?**
(a) 20
(b) 10
(c) $10\sqrt{2}$
(d) $10/\sqrt{2}$

**Q79. The equation of the line joining the points (3,-1) and (-4, 5) is ?**
(a) 6x + 7y + 11 = 0
(b) 6x - 7y - 11 = 0
(c) -6x + 7y + 11 = 0
(d) 6x + 7y - 11 = 0

**Q80. A boat goes down stream 60 km in 2 hours and goes upstream 18 km in 3 hours. The speed of the boat in still water is**
(a) 12 km/hr.
(b) 30 km/hr.
(c) 6 km/hr.
(d) 18 km/hr.

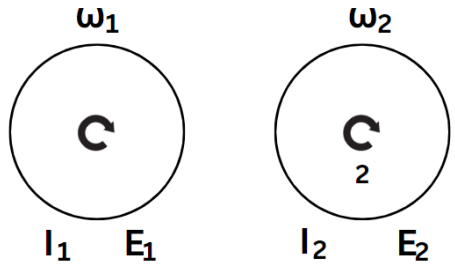
# VSSC TA 2017 SOLUTION

**Ans1. c**
**Solution:**

**Ans2. c**
**Solution:**

**Ans3. d**
**Solution:**

**Ans4. a**
**Solution:**




$I_1 > I_2$
Angular momentum (J) = Iω
$I_1\omega_1 = I_2\omega_2$ .....(1)
Since kinetic energy $E_1 = \frac{1}{2} I_1 \Omega_1^2$ .....(2)
$E_2 = \frac{1}{2} I_2 \Omega_2^2$ .....(3)
Dividing equation 2 by 3
$\frac{E_1}{E_2} = \frac{1/2 I_1 \Omega_1^2}{1/2 I_2 \Omega_2^2}$ .....(4)
Putting value from 1 to 4
$\frac{E_1}{E_2} = \frac{I_2}{I_1}$
Therefore, $E \propto 1/I$
Since $I_1 > I_2$
Therefore $E_1 < E_2$

**Ans5. c**
**Solution:**
Let's assume (H - h) = y
Since, $C_v = \sqrt{\frac{X^2}{4yh}}$
Squaring both side
$C_V^2 = \frac{X^2}{4yh}$
$C_V^2 \times 4yh = x^2$
Taking square root both side
$C_v \times \sqrt{4yh} = x$
Considering $C_v = 1$
$X = 2\sqrt{H}(H-h)$

**Ans6. c**
**Solution:**

**Ans7. c**
**Solution:** Charpy tests show whether a metal can be classified as being either brittle or ductile. This is particularly useful for ferritic steels that show a ductile to brittle transition with decreasing temperature

**Ans8. d**
**Solution:**

**Ans9. b**
**Solution:**

**Ans10. a**
**Solution:**

**Ans11. b**
**Solution:**
The See beck effect is a phenomenon in which a temperature difference between two dissimilar electrical conductors or semiconductors produces a voltage difference between the two substances.

**Ans12. a**
**Solution:**
Emissivity = e/E
Where e is emissive power and E is the emissive power of the black body
The value of emissivity lies between 0 and 1, where the emissivity of the perfect black body is 1.

**Ans13. d**

**Solution:** The Bernoulli Equation can be considered to be a statement of the conservation of energy principle appropriate for flowing fluids. It states that, in a steady flow, the sum of all forms of energy in a fluid along a streamline is the same at all points on that streamline.

**Ans14. a**

**Solution:**

For a collision between two objects, the coefficient of restitution is the ratio of the relative speed after to the relative speed before the collision.

The coefficient of restitution is a number between 0 (perfectly inelastic collision) and 1 (elastic collision) inclusive.

Coefficient of restitution (e)

$$\frac{Relative\ velocity\ after\ collosion}{Relative\ velocity\ before\ collosion} = \frac{v_b - v_a}{u_a - u_b}$$

In the case of a ball bouncing off a flat, stationary surface, the coefficient of restitution turns out to be: v/u

**Ans15. b**

**Solution:**

**Ans16. a**

**Solution:**

We know that rate of radiation heat transfer per unit area is proportional to $T^4$ .

$P \propto AT^4$ ( P is radiation power )

Also surface area, $A \propto r^2$

$\Rightarrow P \propto r^2$ . . . . . (i)

**Ans17. b**

**Solution:**

**Ans18. b**

**Solution:**

**Ans19. c**

**Solution:**

**Ans20. c**

**Solution:**

**Ans21. a**

**Solution:**

N = 0.5, $V_2 = \frac{V_1}{2}$

$VT^n = C$

$VT^{0.5} = C$

$V \propto \frac{1}{\sqrt{T}}$

$\frac{V_2}{V_1} = \sqrt{\frac{T_1}{T_2}}$

$\frac{1}{2} = \sqrt{\frac{T_1}{T_2}}$

$\frac{T_1}{T_2} = \frac{1}{4}$

$T_2 = 4T_1$

% increase in tool life = $\frac{T_2 - T_1}{T_1} \times 100 = 300\%$

**Ans22. c**

**Solution:**

**Ans23. d**

**Solution:**

Lateral deformation ($\epsilon_d$) = -μ × Longitudinal deformation ($\epsilon_l$)

So, to calculate the change in diameter ($\epsilon_d$) we need both μ and longitudinal deformation.

From the relation E = 2G(1+μ) we can calculate Poisson's ratio if we know the value of both Shear Modulus (G) and Young's Modulus (E).

**Ans24. a**

**Solution:**

**Ans25. c**

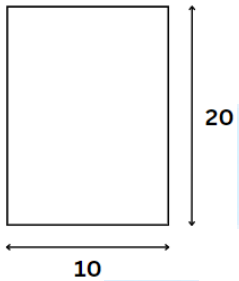
**Solution:**

**Ans26. b**

**Solution:**

**Ans27. c**
**Solution:**

**Ans28. b**
**Solution:**
Slenderness ratio = $\frac{\text{Effective length } L_E}{\text{Minimum radius of gyration k}}$




$I_{xx} = \frac{Bd^3}{12} = \frac{10\times(20)^3}{121} = 6666.67mm^4$

$I_{YY} = \frac{Db^3}{12} = \frac{20\times(10)^3}{12} = 1666.67mm^4$

Since, $I_{YY} < I_{xx}$

$\therefore\ I = A\,k^2$

$K = \sqrt{\frac{I}{A}}$

$K_{min} = \sqrt{\frac{I_{Y-y}}{A}} = \sqrt{\frac{1666.67}{200}}$

$K_{min} = 2.888mm$

Therefore Slenderness ratio = $\frac{1000}{2.888} = 346.26$

**Ans29. b**
**Solution:**

**Ans30. c**
**Solution:**
Applying second equation of motion
S = 4.9m

**Ans31. d**
**Solution:**

**Ans32. d**
**Solution:**

**Ans33. a**
**Solution:**

**Ans34. a**
**Solution:**
$\Sigma_H = \frac{Pd}{2t}$
$T = \frac{9}{2} \times \frac{500}{180} = 12.5mm$

**Ans35. d**
**Solution:**
Stiffness of the spring is given by:
$$k = \frac{W}{\delta} = \frac{Gd^4}{8D^3n}$$

**Ans36. d**
**Solution:**
$R_{max} = \frac{u^2}{g}$

**Ans37. a**
**Solution:**

**Ans38. b**
**Solution:**
Since $\frac{P^2}{H^3D^4} = \text{Constant}$
$P_2^2 = (P_1)^2 \times \left(\frac{H_2}{H_1}\right)^3$
$P_2^2 = (1000)^2 \times \left(\frac{20}{40}\right)^3 = 354kW$

**Ans39. b**
**Solution:**

**Ans40. b**
**Solution:**

**Ans41. b**
**Solution:**

**Ans42. b**
**Solution:**
As acceleration due to gravity is zero in space Therefore weight of a planet which orbits around the earth = m*g = m*0 = 0

**Ans43. d**

**Solution:** Hydrogen is a common impurity in steel, and its presence can have significant effects on the material properties. Here are the effects of hydrogen in steel:

1. Embrittlement
2. Reduced Ductility
3. Delayed Cracking
4. Corrosion

**Ans44. c**

**Solution:**

**Ans45. b**

**Solution:**

$m_1 > m_2$ and,

Two bodies have the same kinetic energy

$$\frac{1}{2}m_1v_1^2 = \frac{1}{2}m_2v_2^2$$

We can rewrite it as,

$$\frac{1}{2} \times \frac{(m_1 \times v_1)^2}{m_1} = \frac{1}{2} \times \frac{(m_2 \times v_2)^2}{m_2}$$

$$\frac{p_1^2}{m_1} = \frac{p_2^2}{m_2}$$

$$\frac{p_1}{p_2} = \sqrt{\frac{m_1}{m_2}} \text{ ----------(3)}$$

Since $m_1 > m_2$ RHS becomes greater than 1, which implies

$$\frac{p_1}{p_2} > 1$$

**Ans46. d**

**Solution:**

**Ans47. b**

**Solution:** Size of the hole is kept constant and the size of the shaft is varied to get the different class of fits. In this system, a lower deviation of the hole is zero, i.e. The low limit of the hole is same as basic size. The high limit of the hole and the two limits of size for the shaft are then varied to give the desired type of fit.

**Ans48. c**

**Solution:**

**Ans49. a**

**Solution:** The heat-affected zone (HAZ) is the area of the base material, either a metal or a thermoplastic, which is not melted and has had its microstructure and properties altered by welding or heat intensive cutting operations. The extent and magnitude of property change depend primarily on the base material, the weld filler metal, and the amount and concentration of heat input by the welding process.

**Ans50. c**

**Solution:**

**Ans51. d**

**Solution:**

I = 5000Amp

R = 200 micro ohm = $200\times 10^{-6}\Omega$

T = 0.2 sec, H = ?

Since, $H = I^2RT$

$H = (5000)^2 \times 200 \times 10^{-6} \times 0.2$

H = 1000J

**Ans52. c**

**Solution:**

**Ans53. b**

**Solution:**

**Ans54. d**

**Solution:**

**Ans55. b**

**Solution:**

Using Kirchhoff's law

Equivalent resistance = $R_1 + R_2$

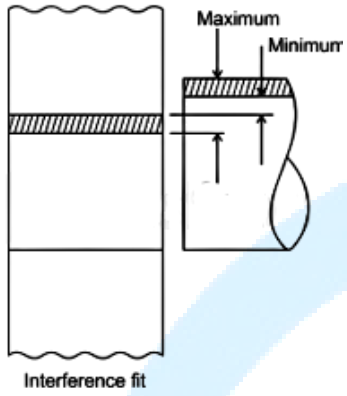
$R_1 = \frac{1}{K_1}\frac{L_1}{A_1}$, $R_2 = \frac{1}{K_2}\frac{L_1}{A_2}$

From question, $l_1 = l_2$ and $A_1 = A_2$

$R_{eq} = \frac{2l}{K_{Eq}A} = \frac{L}{K_1A} + \frac{L}{K_2A}$

$K_{Eq} = \frac{2K_1K_2}{K_1+K_2}$

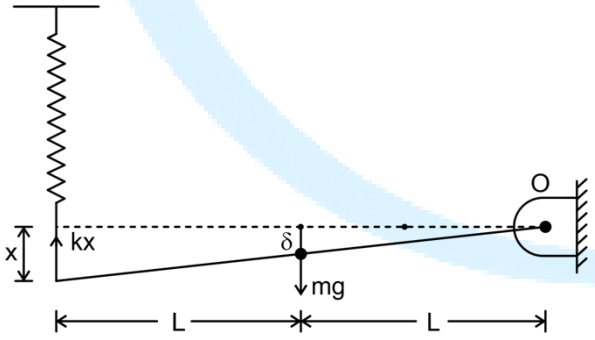
**Ans56. a**
**Solution:**
The diameter of the shaft is always larger than the hole diameter.




**Ans57. c**
**Solution:**
$\text{COP} = \frac{\text{Desired effect}}{\text{Work input}} = \frac{90}{30} = 3$

**Ans58. b**
**Solution:**

**Ans59. d**
**Solution:**
Displacing rod by small distance x




Taking moment about 'O'
$Kx \times 2L = mg \times L$
$X = \frac{Mg}{2K}$
From similar triangle property
$\frac{X}{2L} = \frac{\Delta}{L}$
$\Delta = \frac{X}{2} = \frac{Mg}{4k}$
Using static deflection of the mass 'm'
$\Omega_n = \sqrt{\frac{G}{\Delta}} = \sqrt{\frac{4K}{M}}$

**Ans60. b**
**Solution:**

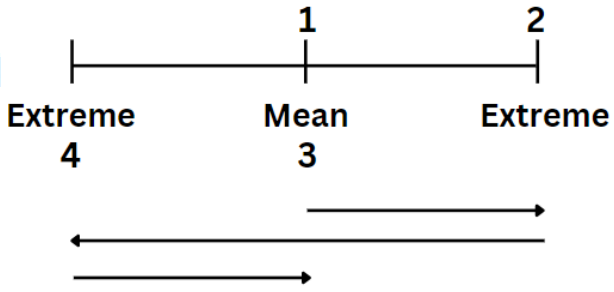
**Ans61. d**
**Solution:** If a closed system is undergoing an irreversible process, the entropy of the system can increase, decrease or remain constant. This is because the change in entropy of a system undergoing an irreversible process depends on the nature of the process and the initial and final states of the system.

**Ans62. c**
**Solution:**

**Ans63. a**
**Solution:**

**Ans64. d**
**Solution:** High cutting speed results in lesser chip tool contact time and better heat dissipation. These two effects make it infavourable condition to form a bond between tool and chip and the coefficient of friction is reduced.

**Ans65. d**
**Solution:**




In a single cycle that is from point 12341 kinetic energy reaches its maximum value

two times. So we can say that if the frequency of the SHM is f then its frequency will be 2 times that is 2f when its kinetic energy changes to potential energy.

**Ans66. b**
**Solution:**

Maximum shear stress is given by

$$T_{max} = \frac{\Sigma_{Max} - \Sigma_{Min}}{2} = \sqrt{\left(\frac{\Sigma_{Xx} - \Sigma_{Yy}}{2}\right)^2 + T_{Xy}^2}$$

$$T_{max} = R = \sqrt{\left(\frac{60-120}{2}\right)^2 + 40^2}$$

-> R = 50 MPa

**Ans67. a**
**Solution:**

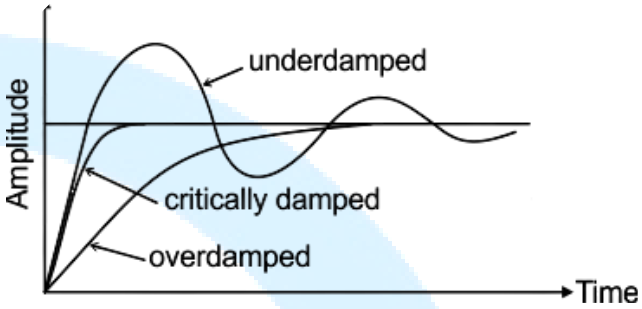
**Ans68. c**
**Solution:**

**Ans69. d**
**Solution:** In other words, if the material is constrained (i.e. Body is not allowed to expand or contract freely), change in length due to rise or fall of temperature is prevented, stresses are developed in the body which is kNown as thermal stress.

**Ans70. c**
**Solution:**

**Ans71. b**
**Solution:**
**Exact straight-line motion mechanisms :**
Mechanisms in which coincidence of the coupler curve arcs with a straight line is theoretically exact **Example**: Peaucellier mechanism, Hart's mechanism, Scott Russell's Mechanism
**Approximate straight-line motion mechanisms :**
Mechanisms in which coincidence of the coupler curve arcs with a straight line is only approximate **Example**: Watt's mechanism, Modified Scott-Russell mechanism

**Ans72. b**
**Solution:** Damping ratio (ζ): The ratio of the actual damping coefficient (C) to the critical damping coefficient Cc) is known as damping factor or damping ratio.




Over damped System: ζ > 1
Underdamped: ζ < 1
Critical Damping: ζ = 1
The displacement will be approaching to zero in the shortest possible time. The system does not undergo a vibratory motion.

**Ans73. d**
**Solution:**

**Ans74. b**
**Solution:** Blaise Pascal that states that a pressure change at any point in a confined incompressible fluid is transmitted throughout the fluid such that the same change occurs everywhere.

**Ans75. b**
**Solution:**
Elementary events associated to random tossing of two coins is HH, HT, TH, TT = 4
At least one tail means 1 or more than 1 tail I.e. TH, HT, TT.
So, no. Of favourable events = 3
Required probability = $\frac{3}{4}$

**Ans76. a**
**Solution:**
We already have our first value 450 and the second value 67.5. Let's assume the unknown value is Y which answer we will find out.
As we have all the required values we need, Now we can put them in a simple mathematical formula as below:
Y = 67.5/450
By multiplying both numerator and denominator by 100 we will get:
Y = 67.5/450 × 100/100 = 15 /100
Y = 15
Finally, we have found the value of Y which is 15
Or
67.5 ÷ 450 × 100 = 15

**Ans77. b**
**Solution:**
We know that $T_{r+1} = C_r a^{n-r} b^r$.
In the given binomial expression $( x + \frac{1}{x} )^{10}$, n = 10, a = x and b = $\frac{1}{x}$.
$\therefore T_{r+1} = {}^{10}C_r x^{10-r}\left(\frac{1}{x}\right)^r = {}^{10}C_r (1)^r (x)^{10-2r}$
For the term to be independent of x, we must have 10 - 2r = 0
R =5.
The required term is:
${}^{10}C_5(1)^5 = {}^{10}C_5 = 252$

**Ans78. b**
**Solution:**
Let horizontal distance be 'b'
$Cos45° = b/10\sqrt{2}$
$1/\sqrt{2} = b/10\sqrt{2}$
B=10

**Ans79. d**
**Solution:**
$Y - Y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$
$Y + 1 = \frac{5-1}{-4-3}(x - 3)$
$-7y - 7 = 6(x-3)$
$6x + 7y - 11 = 0$

**Ans80. d**
**Solution:**
Let the speed of boat be B and the speed of stream be S.
⇒ Speed of the boat in downstream = 60/2 = 30km/hour
⇒ Speed of the boat in upstream = 18/3 = 6km/hour
⇒ Speed of the boat = (30 +6)/2 = 18km/hour