

- Which one of these joints are **not** used in C.I. pipes ?
 (A) Tyton joint
 (B) Simplex joint
 (C) Flanged joint
 (D) Spigot and socket joint
- If T_1 is the source temperature and T_2 is the sink temperature, the more effective way to increase the efficiency of a Carnot engine is
 (A) Decrease T_2 keeping T_1 constant
 (B) Decrease T_1 keeping T_2 constant
 (C) Increase T_2 keeping T_1 constant
 (D) Increase T_1 keeping T_2 constant
- When the magnetic bearing of the sun at noon is $185^\circ 20'$, the magnetic declination will be
 (A) $5^\circ 20'$ North
 (B) $5^\circ 20'$ South
 (C) $5^\circ 20'$ West
 (D) $5^\circ 20'$ East

Handwritten: $185^\circ 20' - 180^\circ = 5^\circ 20'$
- The net heat transfer by radiation from a body at temperature (T_1) to another body or surrounding at temperature (T_2) is given by
 (where, σ = Radiation constant for a perfect black body and ϵ = Emissivity of a body at a particular temperature)
 (A) $Q = \sigma \epsilon_2 (T_1^2 - T_2^2) W/m^2$
 (B) $Q = \sigma \epsilon_1 (T_1^4 + T_2^4) W/m^2$
 (C) $Q = \sigma \epsilon_2 (T_1^4 - T_2^4) W/m^2$
 (D) $Q = \sigma \epsilon_1 (T_1^4 - T_2^4) W/m^2$
- Gypsum is added in the manufacturing of Portland Cement
 (A) At the beginning of grinding the clinker,
 (B) At the end of grinding the clinker into powder
 (C) During burning in the rotary kiln
 (D) While mixing the raw material
- The strength of current in 2 H inductor changes at a rate of 3 A/s. The voltage across it and the magnitude of energy stored in the inductor after 4 seconds are
 (A) $V_L = 1.5$ V; $W_L = 12$ J
 (B) $V_L = 1.5$ V; $W_L = 144$ J
 (C) $V_L = 6$ V; $W_L = 72$ J
 (D) $V_L = 6$ V; $W_L = 144$ J
- A particle of mass 1 kg resting on rough contact with a plane inclined at 30° to the horizontal is just about to slip. The coefficient of friction between the plane and the particle will be
 (A) $2\sqrt{3}$
 (B) $\frac{1}{3}$
 (C) $\frac{1}{\sqrt{3}}$
 (D) $\sqrt{3}$

*Handwritten diagram: A block on an inclined plane at 30° .
 $10 \times 10^3 \times \frac{1}{2} = 11 \times 10^3$
 $\mu = \frac{1}{2}$*
- For the same compression ratio, the Brayton cycle efficiency as compared to that of the Otto cycle is
 (A) Equal
 (B) Less
 (C) Greater
 (D) Not related

9. The loss of head due to frictional resistance due to flow of liquid in a long straight pipe of length (L) and diameter (D) is given by
(where, f is the friction factor of the pipe and V is the mean velocity of flow in the pipe.)

(A) $2 \frac{fLV^2}{gD}$
(B) $\frac{fLV}{2gD}$
(C) $\frac{fV^2}{L\sqrt{2gD}}$
(D) $\frac{fLV^2}{2gD}$

10. Relative permeability of vacuum is

(A) 1
(B) $\frac{1}{4}\pi$
(C) $1H/m$
(D) $4\pi \cdot 10^{-7} H/m$

11. An angle made by a survey line with the prolongation of the proceeding line, is known as

(A) Horizontal angle
(B) Deflection angle
(C) Vertical angle
(D) Direct angle

12. The specific speed, (N_s) of a Centrifugal Pump is given by
(where, H_m is the available head from the pump and Q corresponding to the maximum efficiency of the pump at its normal working speed N)

(A) $N_s = \frac{N\sqrt{Q}}{H_m^{3/4}}$
(B) $N_s = \frac{Q\sqrt{N}}{H_m^{3/4}}$
(C) $N_s = \frac{\sqrt{NQ}}{H_m^{3/4}}$
(D) $N_s = \frac{N\sqrt{Q}}{H_m^{3/4}}$

13. A thin cylindrical shell of diameter (d) and thickness (t) is subjected to an internal pressure (P). The ratio of longitudinal strain to volumetric strain is
(where, $\frac{1}{m} = \text{Poisson's ratio}$)

(A) $\frac{m-2}{3m-4}$
(B) $\frac{m-2}{5m-4}$
(C) $\frac{2m-1}{2m-1}$
(D) $\frac{m-1}{2m-1}$

14. Newton's formula for convective heat transfer from a fluid to a metallic wall or from a metallic wall to a fluid is

(where, Q = heat transfer by convection in J/S, h = heat transfer or film coefficient in J/m^2 Cs or W/m^2 C, a = surface area through which heat is transferred in m^2 , t_s = temperature of the surface or wall in $^{\circ}C$ and t_f = temperature of the fluid in $^{\circ}C$)

(A) $Q = ha(t_f - t_s)$

(B) $Q = ha\sqrt{(t_s - t_f)^2}$

(C) $Q = ha(t_s + t_f)$

(D) $Q = ha(t_s - t_f)$

15. A dummy activity

- (A) does not consume time
(B) is represented by dotted lines
(C) is artificially introduced
(D) all of the above

16. For prevention of dental caries in children, the recommended fluoride concentration in water should be in the range of

- (A) 1.2 – 1.7
(B) 1.7 – 2.2
(C) 0.7 – 1.2
(D) 0.2 – 0.7

17. When a body is subjected to bi-axial stress, i.e. direct stress (P_1) and (P_2) in two mutually perpendicular planes accompanied by a simple shear stress (q), then maximum normal stress is

(A) $\frac{P_1 - P_2}{2} + \frac{1}{2}\sqrt{(P_1 + P_2)^2 + 4q^2}$

(B) $\frac{P_1 - P_2}{2} - \frac{1}{2}\sqrt{(P_1 + P_2)^2 + 4q^2}$

(C) $\frac{P_1 + P_2}{2} - \frac{1}{2}\sqrt{(P_1 - P_2)^2 + 4q^2}$

(D) $\frac{P_1 + P_2}{2} + \frac{1}{2}\sqrt{(P_1 - P_2)^2 + 4q^2}$

18. For complete similarity to exist between the model and its prototype, there should be

- (A) Only dynamic similarity
(B) Geometric, kinematic and dynamic similarity
(C) Only kinematic similarity
(D) Only geometric similarity

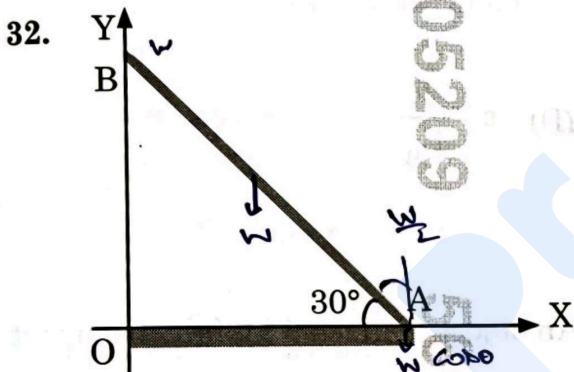
19. The method of levelling in which the heights of mountains are found by observing the temperature at which water boils, is known as

- (A) Longitudinal levelling
(B) Hypsometry
(C) Reciprocal levelling
(D) Barometric levelling

20. The nodal method of circuit analysis is based on
- (A) KCL and KVL
(B) KCL, KVL and Ohm's Law
(C) KCL and Ohm's Law
(D) KVL and Ohm's Law
21. It is proposed that solar energy be used to warm a large collector plate. The energy would in turn, be transferred as heat to a fluid within a heat engine, and the engine would reject energy as heat to the atmosphere having assumed temperature of 20°C . Experiments indicate that about $1880 \text{ KJ/m}^2\text{h}$ of energy can be collected when the plate is operating at 90°C . The minimum collector area that would be required for plant producing 1 KW of useful shaft power will be approximately
- (A) 15 m^2
(B) 30 m^2
(C) 10 m^2
(D) 20 m^2
22. What is the chemical composition of quicklime ?
- (A) MgO
(B) MgS
(C) CaO
(D) CaS
23. The overall efficiency of Francis Turbine is given by
(where, W is the weight of water per second which strikes the runner, P is the power available at the runner shaft and H is the net head at the runner shaft)
- (A) $\lambda_o = \frac{(2WH)}{P}$
(B) $\lambda_o = \frac{2P}{(WH)}$
(C) $\lambda_o = \frac{(WH)}{P}$
(D) $\lambda_o = \frac{P}{(WH)}$
24. A tank contains oil of specific gravity of 0.9 . The depth of the point below free surface is (where, the pressure intensity is 9 kg(f)/cm^2)
- (A) 10 m
(B) 1 m
(C) 100 m
(D) 1000 m

25. American Public Health Association formula for aeration time (T) in hours is (where, L_a = BOD of the aeration tank sewage influent (mg/litre) to be removed)
- (A) $T = (L_a/2) - 1$
(B) $T = (L_a/4) - 1$
(C) $T = (L_a/20) - 1$ ✓
(D) $T = 2L_a - 1$
26. Vicat's apparatus is used to determine the
- (A) Normal consistency of cement
(B) Final setting time of cement
(C) Initial setting time of cement
(D) All of the above ✓
27. In the case of Rankine cycle, the specific volume of water in the pump is _____ of the steam expanding in the same turbine.
- (A) Equal to
(B) Much more than that
(C) Much less than that ✓
(D) Not related to that
28. A moving coil voltmeter measures
- (A) Only a.c. voltage
(B) Only d.c. voltage
(C) Both a.c. and d.c. voltage
(D) Nothing
29. The total inductance of two coils, A and B, when connected in series is 0.5 H or 0.2 H, depending upon the relative directions of the current in the coils. Coil A, when isolated from coil B, has a self-inductance of 0.2 H. The mutual inductance between the two coils is
- (A) 0.25 H
(B) 0.05 H
(C) 0.15 H ✓
(D) 0.075 H
30. Which of the following constituents, when present in excess quantity, changes the colour of the brick from red to yellow ?
- (A) Limestone
(B) Alkalies
(C) Silica
(D) Alumina ✓

31. Air at a temperature of 15°C passes through a heat exchanger at a velocity of 30 m/s where its temperature is raised to 800°C . It then enters a turbine with the same velocity of 30 m/s and expands until the temperature falls to 650°C . On leaving the turbine, the air is taken at a velocity of 60 m/s to a nozzle, where it expands until the temperature has fallen to 500°C . If the air flow rate is 2 kg/s , the rate of heat transfer to the air in the heat exchanger, by taking the enthalpy of air as $h = C_p t$, where C_p is the specific heat equal to 1.005 KJ/Kg and t being the temperature, is
- (A) 1050 KJ/sec
(B) 4500 KJ/sec
(C) 1300 KJ/sec
(D) 1580 KJ/sec



A rod AB rests with the end A on rough ground and the end B against a smooth vertical wall. The rod is uniform and of weight W . If the rod is in equilibrium in the position shown in figure, the normal reaction at B is

- (A) $\sqrt{3}W$
(B) $\frac{\sqrt{3}}{2}W$
(C) $\frac{W}{2}$
(D) W

33. Rouse distance (x) required for establishment of a fully developed turbulent flow in a pipe of diameter D is given by

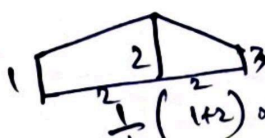
- (A) $\frac{x}{D} = (50)^2$
(B) $\frac{x}{D} = \sqrt{50}$
(C) $x = \frac{50}{D}$
(D) $\frac{x}{D} = 50$

34. Factors not affecting bacterial efficiency of chlorine are

- (A) Ammonia compounds
(B) Coagulants used
(C) Presence of metallic compounds
(D) Turbidity

35. To the sum of the first and the last ordinates, add twice the sum of the intermediate ordinates. The total sum thus obtained is multiplied by the common distance between the ordinates. One-half of this product gives the required area. This rule of finding the area is called

- (A) Average ordinate rule
(B) Simpson's rule
(C) Trapezoidal rule
(D) Mid-ordinate rule



$$\frac{1}{2} \left[2 \left[(1+2) (3+2) \right] \right]$$

$$\frac{1}{2} (2+3) \times 2$$

[P.T.O.]

$$\frac{1}{2} \left[(h_{\text{first}} + h_{\text{last}}) + 2 \left(\sum_{i=1}^{n-1} h_i \right) \right] \Delta x$$

36. Theoretical power required to drive a Single-acting Reciprocating Pump is (where, ω is the specific weight of the liquid, A is the cross-sectional area of piston or the plunger, L is the length of the stroke, N is delivery stroke per minute, H_s is the static head, H_d is the delivery head)

(A) $P = \frac{\omega(ANL)\sqrt{(H_s + H_d)^2}}{60}$

(B) $P = \frac{\omega(ANL)\sqrt{(H_s - H_d)^2}}{60}$

(C) $P = \frac{\omega(ANL)(H_s - H_d)}{60}$

(D) $P = \frac{\omega(ANL)(H_s + H_d)}{60}$

37. The friction factor (f) for laminar flow in a pipe is given by

(A) $f = \frac{8}{R_e}$

(B) $f = \frac{8}{\sqrt{R_e}}$

(C) $f = \frac{64}{\sqrt{R_e}}$

(D) $f = \frac{64}{R_e}$

38. Emissivity factor for the energy emitted by a grey body is given by

(where, E = Energy emitted by a grey body per m^2 per unit time and

E_B = Energy emitted by a perfect black body per m^2 per unit time)

(A) $\varepsilon = \frac{E_B - E}{E_B}$

(B) $\varepsilon = \frac{E_B - E}{E}$

(C) $\varepsilon = \frac{E_B}{E}$

(D) $\varepsilon = \frac{E}{E_B}$

39. An object of mass 5 kg falls from rest through a vertical distance of 20 m and gains a velocity of 10 m/s. The work done by the resistance of the air on the object will be

(A) 550 J

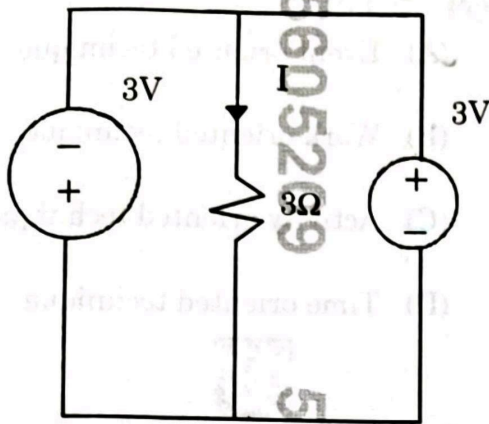
(B) - 750 J

(C) - 550 J

(D) 750 J

W = f s
= $5 \times 10 \times 20$
= 1000

40. In the given circuit, the value of I is



- (A) 2 A
☒ (B) Indeterminate
 (C) -1 A
 (D) 1 A

41. The metallic oxide used in the form of powder in a paint is called

- (A) Vehicle
 (B) Drier
☒ (C) Base
 (D) Extender

42. The hot-wire ammeter

- (A) is used only for a.c. circuits
 (B) reads equally well on d.c. and/or a.c. circuits
 (C) is a high precision instrument
☒ (D) is used only for d.c. circuits

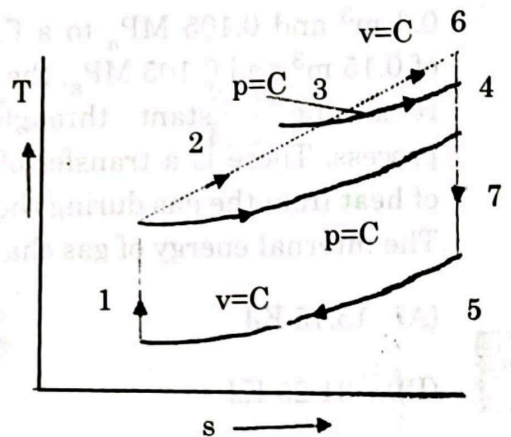
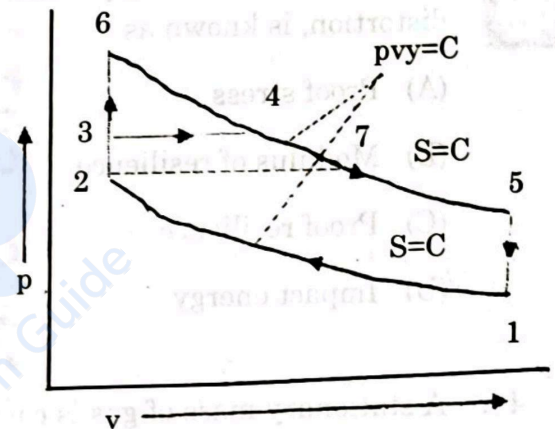
43. Break-even point shows that

- ☒ (A) Sales revenue = Total cost
 (B) Variable cost = Fixed cost
 (C) Sales revenue < Total cost
 (D) Sales revenue > Total cost

44. Dimension of circulation is

- (A) $\frac{L^2}{T^2}$
 (B) $\frac{L}{T}$
 (C) $\frac{L^2}{T}$
☒ (D) $\frac{L}{T^2}$

- 45.



The figures show the compression of Otto, Diesel and Dual cycles for the same compression ratio and heat rejection. The Otto cycle is

- (A) 1-2-3-4-5
 (B) 3-6-4
 (C) 1-2-7-5
☒ (D) 1-2-6-5

46. If the cross slope of a country is 10%, the terrain is classified as
- (A) Mountainous
(B) Steep
(C) Rolling
(D) Plain
47. The strain energy stored in a spring, when subjected to maximum load, without suffering permanent distortion, is known as
- (A) Proof stress
(B) Modulus of resilience
(C) Proof resilience
(D) Impact energy
48. A stationary mass of gas is compressed without friction from an initial state of 0.3 m^3 and 0.105 MP_a to a final state of 0.15 m^3 and 0.105 MP_a , the pressure remaining constant throughout the process. There is a transfer of 37.6 KJ of heat from the gas during the process. The internal energy of gas changes by
- (A) 15.75 KJ
(B) -31.25 KJ
(C) -21.85 KJ
(D) -37.6 KJ
49. PERT is
- (A) Event oriented technique
(B) Work oriented technique
(C) Activity oriented technique
(D) Time oriented technique
50. Mean diameter (or) the pitch diameter (D) of the Pelton Wheel which rotates at N r.p.m. is given by
(where, K_u is the speed of rotation and H is the net head)
- (A) $D = \frac{60(K_u \sqrt{2gH})}{\pi N}$
(B) $D = 60 K_u \sqrt{\frac{2gH}{\pi N}}$
(C) $D = \frac{(\sqrt{2K_u gH})}{\pi N}$
(D) $D = \frac{60(\sqrt{2K_u gH})}{\pi N}$