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1. A four-stage compressor, with perfect intercooling between stages, compresses air from 1 bar to 16 bar. The optimum pressure in the last intercooler will be

(A) 6 bar

(B) 10 bar

(C) 8 bar ✓

(D) 12 bar

2. The concentration of pressure pulses created by an object moving at Mach number of 0.5 is

(A) uniform outside Mach cone

(B) uniform within Mach cone ✓

(C) larger behind the object

(D) larger ahead of the object ✓

3. Thermal conductivity is lower for

(A) wood

(B) air (0.024) ✓

(C) steam at 1 bar

(D) water at 100 °C

4. In case of one-dimensional heat conduction in a medium with constant properties, T is the temperature at position x at time t . Then $\partial T / \partial t$ is proportional to

(A) $\frac{T}{x}$ ✓ $Q = kA \frac{dT}{dx}$

(B) $\frac{\partial T}{\partial x}$

(C) $\frac{\partial^2 T}{\partial x^2}$ ✓

(D) $\frac{\partial^2 T}{\partial x \cdot \partial t}$

5. When heat is transferred by molecular cooling, it is referred to as heat transfer by

(A) conduction ✓

(B) convection

(C) radiation

(D) scattering

6. The temperature of steam at around 540 °C can be measured by

(A) thermometer

(B) radiation pyrometer

(C) thermopile

(D) thermocouple ✓

7. A composite slab has two layers of different materials with thermal conductivities k_1 and k_2 . If each layer has the same thickness, the equivalent thermal conductivity of the slab would be

(A) $k_1 + k_2$

(B) $\frac{k_1 + k_2}{k_1 \cdot k_2}$

(C) $\frac{2k_1 \cdot k_2}{k_1 + k_2}$

(D) $k_1 \cdot k_2$

8. For a refrigerator operating between 273 K and 303 K, the maximum achievable COP is

(A) 5.1

(B) 8.1

(C) 9.1

(D) 10.1

9. In an ideal vapour compression refrigeration cycle, the specific enthalpy of refrigerant (in kJ/kg) at the following states is given as :

Inlet of condenser : 283

Exit of condenser : 116

Exit of evaporator : 232

The COP of this cycle is

(A) 2.27

(B) 2.75

(C) 3.27

(D) 3.75

10. Which of the following cycles uses air as the refrigerant?

(A) Ericsson

(B) Stirling

(C) Carnot

(D) Bell Coleman

11. The horsepower per ton of refrigeration is expressed as

(A) $\frac{4.75}{\text{COP}}$

(B) $\frac{\text{COP}}{4.75}$

(C) $4.75 \times \text{COP}$

(D) None of the above

$\frac{3.5}{\text{COP}}$

12. Sensible heating or cooling of air is the process of heating or cooling

- (A) at the same humidity ratio ✓
- (B) while changing the humidity ratio
- (C) at constant dry-bulb temperature
- (D) at the same wet-bulb temperature

13. The SI unit of kinematic viscosity is

- (A) $\frac{\text{kg}}{\text{m-s}}$
- (B) m/s^2
- (C) $\frac{\text{m}^3}{\text{s}^2}$
- (D) m^2/s ✓

14. For a Newtonian fluid

- (A) shear stress is proportional to shear strain
- (B) shear stress is proportional to rate of shear strain ✓
- (C) rate of shear stress is proportional to shear strain
- (D) rate of shear stress is proportional to rate of shear strain

15. A streamlined body is defined as a body about which

- (A) the flow is laminar
- (B) the flow is along the streamlines
- (C) the flow separations are suppressed ✓
- (D) the drag is zero

16. Oil flows through a 200 mm diameter horizontal cast iron pipe (friction factor $f = 0.0225$) of length 500 m. The volumetric flow rate is $0.32 \text{ m}^3/\text{s}$. The head loss (in m) due to friction is (assume $g = 9.8 \text{ m/s}^2$)

- (A) 116.18
- (B) 0.116
- (C) 18.22
- (D) 232.36 ✓

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$$y = \frac{32 \times 9 \times 8}{50 \times 10}$$

$$\frac{25}{9} \times \frac{25}{5}$$

$$\begin{aligned} & \frac{0.225 \times 500 \times 16 \times (32)^2}{10^4 \times \pi^2 \times 16 \times 2 \times 9.8 \times 0.2} \\ & \frac{225 \times 500 \times 32 \times 32^2}{100 \times 100 \times 16 \times 2 \times 9.8 \times 0.2} \end{aligned}$$

$$\frac{72}{8.0}$$

17. Kaplan turbine is

- ✗ (A) a high-head mixed flow turbine
- ✓ (B) a low-head axial flow turbine ✓
- (C) an outward flow reaction turbine
- ✗ (D) an impulse inward flow turbine

18. The density of water is maximum at

- (A) 0 K
- (B) 0 °C
- (C) -4 °C
- ✓ (D) 4 °C ✓

19. The condition for the stable equilibrium of a floating body is

- (A) the metacentre should lie above the centre of gravity
- (B) the centre of buoyancy and the centre of gravity must lie on the same vertical line
- (C) a righting couple should be formed
- (D) All of the above ✓

20. Manometer is used to measure

- (A) pressure in pipe, channel, etc.
- (B) atmospheric pressure
- (C) very low pressure
- ✓ (D) difference of pressure between two points

21. A hydraulic press has a ram of 15 cm diameter and plunger of 1.5 cm. It is required to lift a weight of 1 ton. The force required on plunger is equal to

- ✓ (A) 10 kg
- (B) 100 kg
- (C) 1000 kg
- (D) 10000 kg

$$\frac{P}{(15)^2} = \frac{1 \times 1000}{(1.5)^2}$$

$$\frac{1000}{(15)^2} = \frac{F}{(1.5)^2}$$

22. The losses in open channel vary as proportional to

(A) velocity (v)

(B) v^2

(C) v^3

(D) $v^{1/2}$

$$h \propto \frac{v^2}{2g}$$

$$\frac{1}{v^2}$$

23. A flow is called supersonic if the

(A) velocity of flow is very high

(B) discharge is difficult to measure

(C) Mach number is between 1 and 5

(D) Mach number is less than 1

24. The dynamic viscosity of a liquid is $1.2 \times 10^{-4} \text{ N-s/m}^2$, whereas the density is 600 kg/m^3 . The kinematic viscosity (in m^2/s) is

(A) 72×10^{-3}

(B) 20×10^{-8}

(C) 7.2×10^3

(D) 70×10^6

$$\nu = \frac{\mu}{\rho}$$

$$\frac{1.2 \times 10^{-4}}{600}$$

$$2 \times 10^{-7}$$

25. Reynolds' number signifies the ratio of

(A) gravity forces to viscous forces

(B) inertia forces to gravity forces

(C) inertia forces to viscous forces

(D) buoyant forces to inertia forces

26. Refrigerant Freon-12 belongs to

(A) methane family

(B) alkyne family

(C) ketone family

(D) aldehyde family

27. The flow of water in a pipe about 3 metres in diameter can be measured by

(A) orifice plate

(B) venturi meter

(C) Pitot tube

(D) rotameter

28. The characteristic gas constant of a gas is equal to

(A) $\frac{C_p}{C_v}$

(B) $C_v + C_p$

(C) $\frac{C_v}{C_p}$

(D) $C_p - C_v$ ✓

31. A perfect gas at 27°C is heated at constant pressure till its volume is double. The final temperature is

(A) 54°C

(B) 327°C ✓

(C) 654°C

(D) 108°C

$$PV = 300$$

$$P \times 2V = T$$

$$\frac{1}{2} = \frac{300}{T}$$

$$T = \frac{600}{273}$$

29. Boyle's law, i.e., $pV = \text{constant}$, is applicable to gases under

(A) all ranges of pressures

(B) only small range of pressures ✓

(C) only high range of pressures

(D) steady change of pressures

32. If Q_1 is the heat transfer between hot temperature source and machine, and Q_2 is the heat transfer between cold temperature source and machine, then for heat pump, the COP will be equal to

(A) $\frac{Q_1}{Q_1 - Q_2}$ ✓

(B) $\frac{Q_2}{Q_1 - Q_2}$

(C) $\frac{Q_1}{Q_2 - Q_1}$

(D) $\frac{Q_2}{Q_2 - Q_1}$



30. The statement that molecular weights of all gases occupy the same volume is known as

(A) Avogadro's hypothesis ✓

(B) Dalton's law

(C) gas law

(D) law of thermodynamics

33. The air standard efficiency of an Otto cycle is equal to

(A) $-1/(\gamma + 1)$

(B) $r^{\gamma-1} - 1$

(C) $1 - r^{\gamma-1}$

(D) $1 - (1/r^{\gamma-1})$ ✓

34. Heat and work are

(A) intensive properties

(B) extensive properties

(C) point functions

• (D) path functions ✓

35. The air-fuel ratio for idling speed of a petrol engine is approximately

(A) 1 : 1

(B) 5 : 1

(C) 10 : 1 ✓

(D) 15 : 1

36. For a simple compressible system, V , S , P and T are specific volume, specific entropy, pressure and temperature respectively. As per Maxwell's relation

• (A) $\left(\frac{\partial V}{\partial S}\right)_P = \left(\frac{\partial T}{\partial P}\right)_S$ ✓

(B) $\left(\frac{\partial V}{\partial S}\right)_P = \left(\frac{\partial P}{\partial V}\right)_T$

(C) $\left(\frac{\partial V}{\partial S}\right)_P = \left(\frac{\partial S}{\partial T}\right)_P$

(D) $\left(\frac{\partial V}{\partial S}\right)_P = \left(\frac{\partial T}{\partial V}\right)_P$

37. A 5 BHP engine running at full load would consume diesel of the order of

(A) 1 kg/hr ✓

• (B) 5 kg/hr

(C) 3 kg/hr

(D) 0.3 kg/hr

38. High carbon content in diesel oil used for diesel engine leads to

• (A) production of highly corrosive gases corroding the cylinder walls and exhaust system

(B) excessive engine wear

(C) damaging of both the storage tank and the engine

(D) deposition on engine parts ✓

39. In case of diesel engine, mixing of air and fuel occurs in

(A) injection pump

(B) inlet manifold

• (C) engine cylinder ✓

(D) carburetor

40. In a petrol engine, which of the following gases gets exhausted out without burning and without transformation?

(A) O_2

(B) CO_2

• (C) CO

(D) N_2 ✓

41. If diesel is fed by mistake in the oil tank of a petrol engine, then the engine will

(A) give lot of smoke

• (B) detonate

(C) not run

(D) run for some time and then stop

42. An engine at half load begins to act with an increasing load at 970 r.p.m. and with a decreasing load at 980 r.p.m. The sensitivity of the governor is

(A) 5%

(B) 2%

✓ (C) 2.5%

(D) 1%

43. Heating of dry steam above saturation temperature is known as

✓ (A) enthalpy

✓ (B) superheating ✓

(C) supersaturation

✓ (D) supertempering

44. 1 kg steam sample contains 0.4 kg water vapour. Its dryness factor is

• (A) 0.4 ✓

(B) $0.4/1.4$

(C) 0.4×0.6

(D) 0.6

$$\begin{array}{r} 970 \\ 980 \\ \hline 1950 \\ 975 \end{array}$$

$$\frac{10}{975} \times 100$$

45. The basic job of feedwater treatment in boilers is to overcome the problem of

- (A) corrosion
- (B) scale
- (C) carryover
- (D) All of the above ✓

46. If Δh_m and Δh_f are the enthalpy drops in moving and fixed blades respectively, then the degree of reaction is defined as

- (A) $\frac{\Delta h_m}{\Delta h_f}$
- (B) $\frac{\Delta h_f}{\Delta h_m}$
- (C) $\frac{\Delta h_m}{\Delta h_m + \Delta h_f}$ ✓
- (D) $\frac{\Delta h_f}{\Delta h_m + \Delta h_f}$

Δh



48. The compounding of steam turbine is done to

- (A) improve efficiency
- (B) reduce turbine speed ✓
- (C) increase blade speed ratio
- (D) reduce axial thrust

49. The maximum work is done in compressing air when the compression is

- (A) adiabatic ✓
- (B) isothermal
- (C) Both (A) and (B)
- (D) None of the above

47. The maximum blade efficiency of a single-stage impulse turbine having nozzle angle α , under ideal condition, is

- (A) $\cos \alpha / 2$
- (B) $\cos^2 \alpha / 2$
- (C) $\cos 2\alpha$
- (D) $\cos^2 \alpha$ ✓

$$1 + \frac{V_{b2}}{V} \cdot \cos^2 \alpha$$

50. The ideal efficiency of simple gas turbine cycle depends on

- (A) maximum cycle temperature
- (B) pressure ratio ✓
- (C) minimum cycle temperature
- (D) All of the above ✓
