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Class: 11
Subject: Chemistry
Topic: Thermodynamics
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. Water is used as the coolant in the radiator of engines in the motor vehicle because
   A. High thermal capacity
   B. Easy availability
   C. low density
   D. low boiling point

   Sol: A

2. The kinetic energy of one mole of argon gas at 27 ^{0}C is (R = 8.3 J mole / K)
   A. 3735 J
   B. 336.2 J
   C. 2490 J
   D. 224.1 J

   Sol: A

$$\text{K.E.} = 3N \times \frac{1}{2}KT - \frac{3}{2}(N \times K)T - \frac{3}{2}RT - \frac{3 \times 8.3 \times 300}{2} - 3{,}735\ J.$$

3. The molar specific heats of an ideal gas at constant pressure and volume are CP CV. Further$\frac{C_P}{C_V}\gamma$ and R is gas constant, then
   A. $C_V = R$
   B. $C_V = \tilde{a}R$
   C. $C_P = \frac{R}{\gamma - 1}$
   D. $C_P = \frac{\gamma R}{(\gamma - 1)}$

   Sol: D

$$C_P - C_V = R \qquad \frac{C_P}{C_V} = \gamma \qquad \therefore C_V = \frac{C_P}{\gamma}$$

$$\therefore C_P - \frac{C_P}{\gamma} = R \Rightarrow C_P\left|1 - \frac{1}{\gamma}\right| = R \qquad \therefore C_P = \frac{\gamma R}{\gamma - 1}.$$

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4. 10,000 J of heat energy is absorbed from a source at a temperature 500 K and 3500 J of heat energy is rejected to the sink. Thetemperature of the sink is

A. 200 K
B. 175 K
C. 100 K
D. 150 K
Sol: B

$$\frac{Q_1-Q_2}{Q_1}=\frac{T_1-T_2}{T_1}\Rightarrow\frac{10,000-3500}{10,000}=\frac{500-T_2}{500}\Rightarrow\frac{6500}{10000}=\frac{500-T_2}{500}$$

$$325=500-T_2 \qquad \therefore T_2=175K.$$

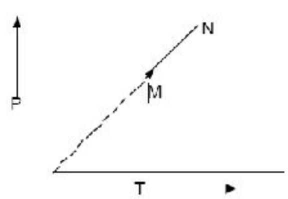
5. The relation between temperature and pressure in an adiabatic change is
A. $\frac{P}{T}$ constant
B. $PT^{\tilde{a}}$ = constant
C. $P^{\tilde{a}}T^{\tilde{a}-1}$ = constant
D. $P^{\tilde{a}-1}T^{\tilde{a}}$ constant
Sol: D

6. If the temperature of patient is 40^{0}C, his temperature on the Farenheit scale will be

A. 104^{0} F
B. 72^{0} F
C. 96^{0}F
D. 100^{0} F
Sol: A

7. The coefficient of linear expansion of iron is 0.000011/K. An iron rod is 10 metre long at 27^{0}C. The length of the rod will bedecreased by 1.1 mm, When the temperature of the rod changes to
A. 0^{0} C
B. 10^{0} C
C. 17^{0}C V
D. 20^{0} C
Sol: C

8. 1 mole of perfect gas is taken from state M to state 'N' as shown by P - T diagram. Then workdone by the gas during the process



A. zero
B. positive

C. negative
D. decreases as the distance of the point on the line from origin decreases
Sol: A

9. The best material for a cooking utensil is one having
A. high specific heat and high conductivity
B. high specific heat and low conductivity
C. low specific heat and high conductivity
D. same specific heat and conductivity
Sol: C

10. 1 mole of a gast with ã = 7/5 is mixed with 1 mole of a gas with ã = 5/3, then the value of ã for the resulting mixture is
A. 7/5
B. 2/5
C. 3/2
D. 12/7
Sol: C

For first gas, $\gamma = \frac{7}{5}$, means gas is diatomic

For second gas , $\gamma = \frac{5}{3}$, means gas in monoatomic

Now, $(C_v)_{mono} = \left(\frac{3}{2}R\right)$ and $(C_v/dt = \frac{5}{2}R)$

$$(C_v)_{mix} = \frac{\frac{3}{2}R + \frac{5}{2}R}{2} \quad (\because \text{ one mole of each gas is taken})$$

$$= 2R$$

$$(C_v)_{mix} = (C_v)_{mix} + R = 2R + R = 3R$$

$$(\gamma)_{mix} - \frac{C_p}{C_v} - \frac{3R}{2R} - \frac{3}{2}$$

11. Two spheres of different materials one with double the radius and one fourth wall thickness of the other are filled with ice. If thetime for complete melting of the ice in the larger radius one is 25 minutes and that for smaller radius one is 16 minutes, the ratio ofthermal conductivities of materials of larger sphere to smaller sphere is

A. 4: 5
B. 5: 4
C. 25: 8
D. 8: 25
Sol: D

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12. Two stars radiate maximum energy at wavelength's 160 nm and 320 nm respectively. The ratio of their temperatures in Kelvin is
A. 1: 2
B. 1: 4
C. 2: 1
D. 4: 1
Sol: C
By Wein' s law, $\lambda_{m1} T_1 = \lambda_{m1} T_2 \qquad \frac{T_1}{T_2} = \frac{\lambda_{m2}}{\lambda_{m1}} = \frac{320}{160} = 2.$

13. The pressure inside a cooking gas cylinder does not fall appreciably till the last few minutes as the gas coming out is
A. mixture
B. a liquid
C. saturated vapours
D. unsaturated vapours
Sol: C

14. An ideal gas heat engine operates in a Carnot cycle between 227^0 C and 127^0 C. It absorbs6.0 x 10^4cals at the higher temperature. The amount of heat converted into work is equal to
A. 4.8 x 10^4cals
B. 3.5 x 10^4cals
C. 1.6 x 10^4cals
D. 1.2 x 10^4cals
Sol: D

15. In a refrigerator heat flows
A. from hot body to cold body
B. In its natural direction
C. in a direction opposite to natural direction
D. first from hot body to cold body & then from cold body to hot body
Sol: C

16. The rate of radiation of black body at 0^0 C is E watt. Then the rate of radiation of this black body at 273^0 C Will be
A. 16 E
B. 8 E
C. 4 E
D. E
Sol: A

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17. Equal volumes of helium and oxygen are filled in identical containers at the same temperature. The ratio of pressure exerted bythem is
A. 4
B. 2
C. 1
D. 8
Sol: D

18. 1 g of steam is sent into 1 g of ice. The resultant temperature of the mixture is
A. 50^0 C
B. l60^0 C
C. 230^0 C
D. 270^0 C
Sol: B

19. For a process dW is the workdone by the gas, dU is change in internal energy, if dW + dU = 0, the process is
A. adiabatic
B. cyclic
C. isothermal
D. isobaric
Sol: A

20. Two conductors of the same material have their diameters in the ratio 1: 2 and their lengths in the ratio 2: 1. If the temperaturedifference between their ends is the same, then ratio of amounts of heat conducted per second through them will be
A. 8: 1
B. 1: 8
C. 4: 1
D. 1: 4
Sol: B

$$\frac{Q_1}{Q_2} = \frac{\frac{KA_1(\theta_2 - \theta_1)}{\ell_1}}{\frac{KA_2(\theta_2 - \theta_1)}{\ell_2}} = \frac{A_1}{A_2} \times \frac{\ell_2}{\ell_1}.$$

$$i.e. \frac{d_1^{\,2}}{d_2^{\,2}} . \frac{\ell_2}{\ell_1} = \left(\frac{1}{2}\right)^2 \times \frac{1}{2} = \frac{1}{8}.$$