WORK SHEET

Q.1 A solid sphere A of mass m rolls without slipping on an inclined plane of inclination 30°. Coefficient of friction of the inclined plane is μ. Then, which of the following options is satisfied when the sphere undergoes pure rolling motion?

(A) $\mu \geq \frac{2\sqrt{3}}{7\sqrt{3}}$ **(B)** $\mu \geq \frac{2}{7\sqrt{3}}$ **(C)** $\mu < \frac{2\sqrt{3}}{7}$ **(D)** $\mu < \frac{2}{7\sqrt{3}}$

Q.2 A block is fastened at one end of a wire and is rotated in a vertical circle of radius R. Determine the ratio of change in length of the wire at the lowest point to that at the highest point of the circle. Assume that speed of the block at highest and lowest points is the same (v).

(A) $\frac{v+gR}{v-gR}$ **(B)** $\frac{v-gR}{v+gR}$ **(C)** $\frac{v^2+gR}{v^2-gR}$ **(D)** $\frac{v^2-gR}{v^2+gR}$

Q.3 The initial volume of water is 2000 cm3. Determine the change in volume of the water when external pressure is changed from 105 Nm^{-2} to 10^6 Nm^{-2}.

[Take compressibility of water as 60×10^{-11} m2/N]

(A) 2.08×10^{-5} m^3 **(B)** 1.08×10^{-6} m^3

(C) 2.08×10^{-6} m^3 **(D)** 1.08×10^{-5} m^3

Q.4 A glass capillary tube of internal radius r = 0.25 mm is immersed in water. The top end of the tube projects by 2 cm above the surface of water. At what angle does the liquid meet the ends of the tube? [surface tension of water = 0.07 Nm^{-2}

(A) 60° **(B)** 0° **(C)** 70° **(D)** 180°

Q.5 A large plastic plate of area 40 m2 is floating on the surface of a river. Determine the tangential force that should be applied on the plastic plate to move the plate at 4 m/s on the surface of the river. The depth of the river is 2 m and coefficient of viscosity of water is 10^{-2} poise.

(A) 0.16 **(B)** 1.6 N **(C)** 0.08 N **(D)** 0.2 N

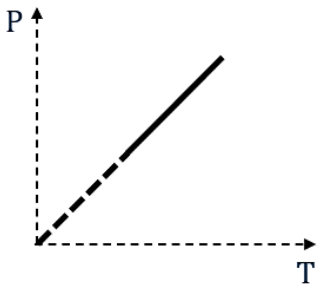
Q.6 Which of the following gases has minimum *rms* speed at a given temperature?

(A) Oxygen **(B)** Nitrogen **(C)** Hydrogen **(D)** Carbon dioxide

Q.7 10 g of ice at −20°C is added to 20 g of water at 20°C. Assuming that no heat is lost to the surrounding, find the temperature of the mixture. [Take, specific heat capacity of ice C_i = 2100 $Jkg^{-1}°C^{-1}$, specific heat capacity of water C_w = 4200 $Jkg^{-1}°C^{-1}$& Latent heat of fusion of ice L = 3.36×105 J kg^{-1}]

(A) 0°C **(B)** 1°C **(C)** 2°C **(D)** 3°C

Q.8 The pressure P of an ideal diatomic gas varies with its absolute temperature T as shown in the figure. The molar heat capacity of the gas during this process is: [R is the gas constant]



(A) 1.7R **(B)** 3.25R **(C)** 2.5R **(D)** 4.2R

Q.9 Two moles of a monoatomic gas is mixed with three moles of a diatomic gas. The molar specific heat of the mixture at a constant volume is

(A) 1.6R **(B)** 2.1R **(C)** 6.25R **(D)** 3.6R

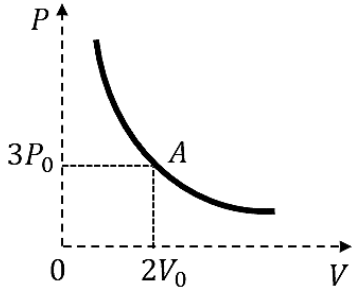
Q.10 A gaseous mixture enclosed in a vessel consists of one gram mole of a gas A with $\gamma = \frac{5}{3}$ and some amount of gas B with $\gamma = \frac{7}{5}$ at a temperature T.
The gases A and B do not react with each other and are assumed to be ideal. Find the number of moles of the gas B if γ for the gaseous mixture is $\left(\frac{19}{13}\right)$

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

Q.11 An ideal monoatomic gas at 300 K expands adiabatically to 8 times its volume. What is the final temperature?

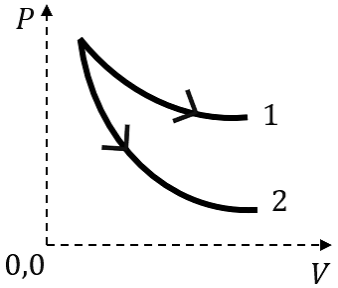
(A) 75 K **(B)** 300 K **(C)** 560K **(D)** 360 K

Q.12 The variation of pressure P with volume V for an ideal monoatomic gas during an adiabatic process is shown in figure. At point A, find the magnitude of the rate of change of pressure with volume.



(A) $\frac{3P_0}{5P_0}$ **(B)** $\frac{5P_0}{3P_0}$ **(C)** $\frac{3P_0}{2V_0}$ **(D)** $\frac{5P_0}{2V_0}$

Q.13 The P − V plots for two gases each undergoing an adiabatic process are as shown in the figure. The graphs 1 and 2 can correspond to: -

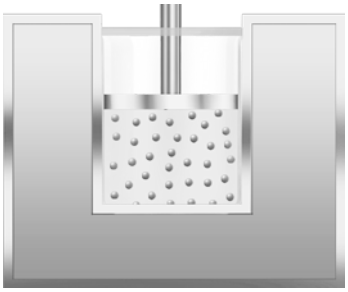


(A) O_2 and He **(B)** He and O_2 **(C)** O_2 and CO **(D)** N_2 and O_2

Q.14 The pressure and density of a diatomic gas ($\gamma = 7/5$) changes from (P, ρ) to (P′, ρ′) during an adiabatic change. If $\frac{\rho'}{\rho} = 32$, then the value of $\frac{P'}{P}$ is

(A) 36 **(B)** $\frac{1}{128}$ **(C)** 128 **(D)** $\frac{1}{36}$

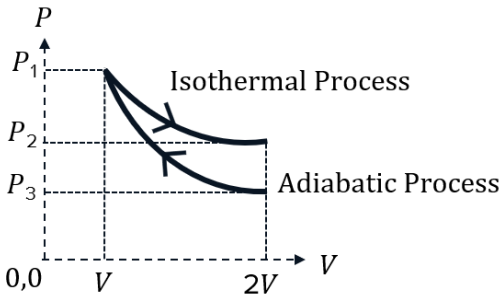
Q.15 1 mole of an ideal gas at initial temperature of T K does 6R joules of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is $\frac{5}{3}$, then final temperature of the gas will be



(A)(T – 4) K **(B)**(T + 4) K **(C)** (T + 2.4) K **(D)**(T – 2.4) K

Q.16 In the figure
A sample of air is kept in a container having walls which are slightly conducting. The initial temperature and volume are 27°C and 800 $cm3$ respectively. Find the rise in temperature if the gas is compressed to 200 cm^3.
(i) in a short time
(ii) in a sufficiently long time
[Take $\gamma = 1.4$ and $4^{0.4} = 1.74$]
(A)(i) 522 K (ii) 0 K **(B)**(i) 0 K (ii) 522 K **(C)**(i) 222 K (ii) 0 K **(D)** (i) 0K (ii) 222 K

Q.17 Neon gas of a given mass expands isothermally to double its original volume. What should be the fractional decrease in pressure, so that the gas when adiabatically compressed from that state, reaches the original state?



(A)$1 - 2^{-2/3}$ **(B)**$1 - 2^{2/3}$ **(C)** $2^{-5/3}$ **(D)** $2^{2/3}$

Q.18 A carbon ball at 40°C is dropped from a height of 5 km. The ball is heated due to air resistance, and it completely melts just before reaching the ground. The specific heat capacity of carbon is 125 Jkg^{-1} $0C^{-1}$ and melting point is 340°C. Then, the latent heat of the fusion of the ball (in kJ kg^{-1}) is [Take g = 10 m/s^2]

Q.19 A rectangular metal plate having length 1.2 m and breadth 0.8 mis heated from10°Cto 110°C.Then, choose the correct option(s): [Given, coefficient of linear expansion of metal $\alpha = 1.5 \times 10^{-5}$/°C]
(A) The change in breadth of the rectangular plate is 1.2×10^{-3} m.
(B) The change in area of the rectangular plate is $1.2m^2$.
(C) The change in length of the rectangular plate is 1.8×10^{-3} m.
(D) The change in area of the rectangular plate is 2.88×10^{-3} m^2.

Q.20 A mixture of Nitrogen and Oxygen has volume 3000 cm3 at temperature 300 K, pressure 200 kPa and mass 6.88 g. Then, which of the following options is/are correct?
[Take R = 8.3 J/mol K]
(A) Mass of Nitrogen in the mixture is 5.6 g **(B)**Mass of Nitrogen in the mixture is 1.28 g.
(C) Mass of Oxygen in the mixture is 1.28 g. **(D)**Mass of oxygen in the mixture is 5.6 g.

ANSWER KEY

WORK SHEET										
Q.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sol.	(B)	(C)	(B)	(C)	(C)	(D)	(A)	(C)	(B)	(B)
Q.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Sol.	(A)	(D)	(A)	(C)	(A)	(C)	(A)		(A), (C), (D)	(A), (C)