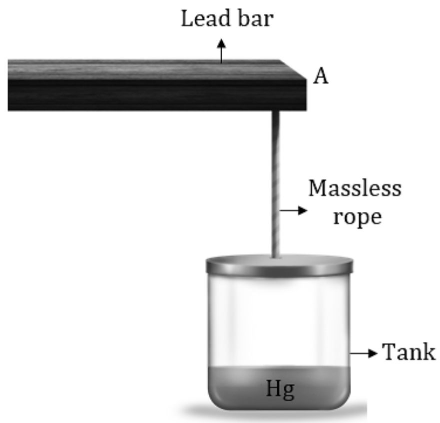
WORK SHEET

Q.1 A lead bar of length 50 cm and square cross-section of side 5 cm is fixed to a vertical wall as shown in figure. A massless tank is suspended from the end of the bar with the help of a massless rope. The tank is slowly filled with mercury at room temperature. Find the level of mercury in the tank so that the end of the bar deviates by 1 mm. [Take modulus of rigidity for lead as 5.6 GPa and area of base of cylindrical tank as $0.42\ \mathrm{m}^2, \rho H_g = 13600\ \mathrm{kg/m^3}$ & $g = 9.8\ \mathrm{m/s^2}$]



(A)0.21m **(B)**1m **(C)**0.5 m **(D)** 0.42 m

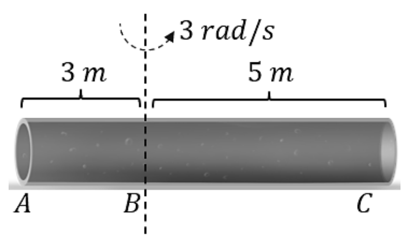
Q.2 A steel rod of 10 mm diameter is loaded with a force of 20 kN. Change in diameter of the rod is 3.82×10^{-3} mm. Given, Young's modulus for steel is 200 GPa, find its Poison's ratio.

(A)0.30 **(B)**0.28 **(C)**0.21 **(D)**0.88

Q.3 A tap is attached to a water tank as shown in figure. Water level above the tap is maintained at $h = 0.2$ m. The cross-sectional area of the tap is $\sqrt{2} \times 10^{-4}\mathrm{m}^2$. Assuming constant pressure throughout the stream of water, find the velocity and cross-sectional area of the stream 0.2 m below the opening of the tap: - [Assume $g = 10\ \mathrm{m/s^2}$]

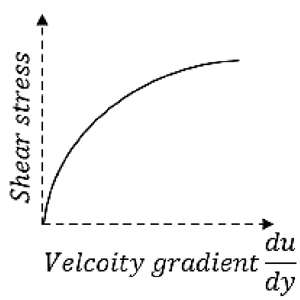
(A)$2\sqrt{2}\ m/s;\ 10^{-4}\ m^2$ **(B)**$1\ \mathrm{m/s};\ 10^{-4}\ \mathrm{m}^2$ **(C)**$2\ \mathrm{m/s};\ 10^{-4}\ \mathrm{m}^2$ **(D)**$2\ \mathrm{m/s};\ 10^{-5}\ \mathrm{m}^2$

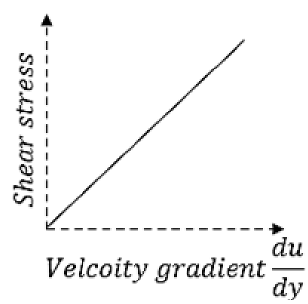
Q.4 A closed tube filled with water is rotating as shown in figure. The pressure difference $P_A - P_C$ is

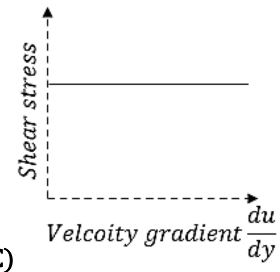


(A)$-6.1 \times 10^4\ \mathrm{N/m^2}$ **(B)**$-5.2 \times 10^4\ \mathrm{N/m^2}$ **(C)**$-7.2 \times 10^4\ \mathrm{N/m^2}$ **(D)** $-2.4 \times 10^4\ \mathrm{N/m^2}$

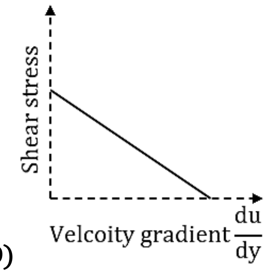
Q.5 Which of the following graph shows the relation between shear stress and velocity gradient for a non-Newtonian fluid?

(A)


(B)




(C)



(D)

Q.6 A soap bubble of diameter 10 mm has an excess pressure of 50 N/m^2. Find the surface tension of soap solution.

(A)0.31 N/m **(B)**0.063 N/m **(C)** 0.063 N/ m^2 **(D)**0.031 N/ m^2

Q.7 Find the temperature at which molecules of oxygen gas have the same rms speed as that of Helium atoms at 240 K. {Molecular mass of $O_2 = 32$ g/mol & He = 4 g/mol}

(A)1920 K **(B)**2400°C **(C)** 24 K **(D)**758.95 K

Q.8 Two rods, one of Aluminium and the other of steel, having initial length l_1 $and l_2$ respectively are connected together to form a single rod of length $l_1 + l_2$. The coefficients of linear expansion for aluminium and steel are α_a and α_s respectively. If the length of each rod increases by the same amount when their temperatures are raised by t ^{o}C, then find the ratio $l_1/(l_1 + l_2)$

(A)a_s/a_a **(B)**a_a/a_s **(C)**$a_s/(a_a + a_s)$ **(D)**$a_a/(a_a + a_s)$

Q.9 A glass bottle of temperature rise. volume 5 litres is filled with gasoline at room temperature. Accidently, the bottle was left close to an engine exhaust and the temperature rises by 40^{o}C. Calculate the volume of gasoline that spills out of the glass bottle as a result of this [Take room temperature to be 25^{o}C, coefficient of linear expansion of glass as $8.5 \times 10^{-6}/^o$C, volumetric coefficient of gasoline at 25^{o}C as $950 \times 10^{-6}/^o$C].

(A)184.9 cc **(B)**184.9 liters **(C)** 190 cc **(D)**5.1 cc

Q.10 A scale which is calibrated at 10^{o}C measures the length of a stick to be 60 cm, at temperature as 30^{o}C. If thermal coefficient of linear expansion of the rod is $2 \times 10^{-5}/^o$C, the correct length of the stick in cm is:

(A)60.015 **(B)**60.024 **(C)**60.400 **(D)** 60.600

Q.11 A triatomic, diatomic and monoatomic gas are supplied with the same amount of heat at a constant pressure. Then:

(A) Fraction of energy used to change internal energy for maximum in monoatomic gas.
(B) Fraction of energy used to change internal energy is maximum for diatomic gas.
(C) Fraction of energy used to change internal energy is maximum for triatomic gas.
(D) Fraction of energy used to change internal energy is same for all the three gases.

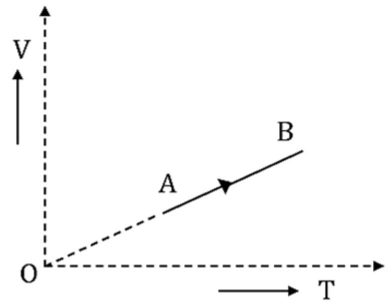
Q.12 The initial pressure and volume of a given mass of gas with $\frac{C_P}{C_V} = \frac{7}{5}$ are 2 atm and 4.8 m^3. The gas can exchange 1.2 m^3 and then slowly compressed to 0.6 m^3. Find the final pressure of the gas.

(A)$2\frac{11}{4}$atm **(B)**4 atm **(C)**16 atm **(D)**$2\frac{24}{5}$atm

Q.13 Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300 K. The piston of A is free to move, while that of B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30 K, then the rise in temperature of the gas in B is:

(A)30 K **(B)**18 K **(C)**50 K **(D)** 42 K

Q.14 The volume V of a monoatomic gas varies with its temperature T, as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B, is

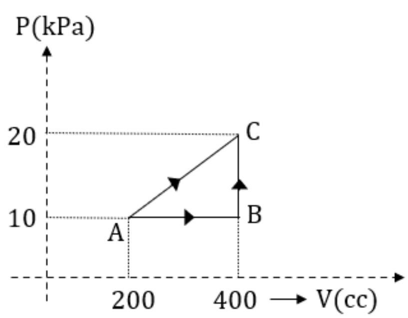


(A) $\frac{2}{5}$ **(B)** $\frac{2}{3}$ **(C)** $\frac{2}{7}$ **(D)** $\frac{1}{3}$

Q.15 Figure shows a cylindrical container containing oxygen gas and closed by a piston of mass 50 kg. Piston can slide smoothly in the cylinder. Its cross-sectional area is 100 cm^2 and atmospheric pressure is 10^5Pa. Some heat is supplied to the cylinder so that the piston is slowly displaced up by 20 cm. Find the amount of heat supplied to the gas.

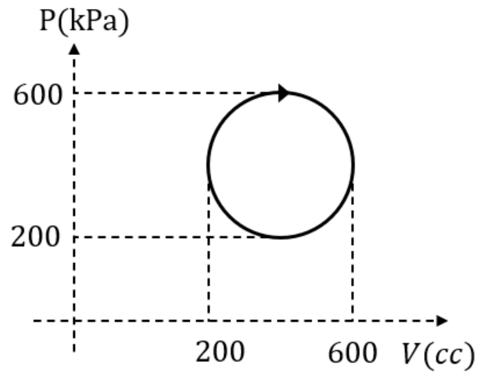
(A)(T – 4) K **(B)**(T + 4) K **(C)** (T + 2.4) K **(D)**(T – 2.4) K

Q.16 If a gas is taken from A to C through B, then heat absorbed by the gas is 8 J. Heat absorbed by the gas in taking it directly from A to C is



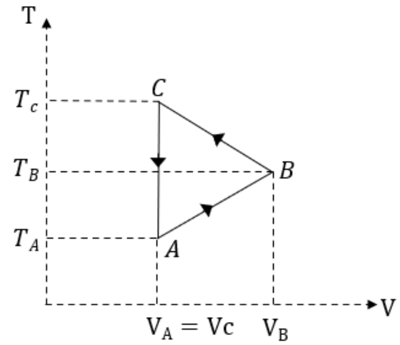
(A)+8J **(B)**+9J **(C)**+5J **(D)**+7J

Q.17 Calculate the heat absorbed by the system undergoing a cyclic process as shown in the figure below.



(A) $40\pi\ J$ **(B)** $-7\pi\ J$ **(C)** $7\pi\ J$ **(D)** $-40\pi\ J$

Q.18 Three moles of an ideal gas are taken through a cyclic process ABCA as shown in T – V indicator diagram. The gas loses 2510 J of heat in the complete cycle. If $T_A = 100$ K and $T_B = 200$ K, the work done by the gas during the process BC is (line AB if extended passes through origin)



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

(A) $5000\ J$ **(B)** $-5000\ J$ **(C)** $4000\ J$ **(D)** $-2500\ J$

Q.19 24 J of heat is added to a diatomic gas in a process in which the gas performs 8 J of work. Find the molar heat capacity of the gas during the process.

(A) 4R **(B)** $\frac{6R}{5}$ **(C)** 3R **(D)** $\frac{15R}{4}$

Q.20 The initial pressure and volume of a given mass of gas having $\gamma = \frac{C_P}{C_V}$ are P_0 and V_0. The gas is separated from the surroundings by a diathermic wall. It is suddenly compressed to $\frac{V_o}{6}$ and then slowly compressed to $\frac{V_o}{36}$. If the final pressure of the gas is $n^{\gamma+1}$, value of n is

ANSWER KEY