PHYSICS CLASSES BY NAYAN JHA

Important questions of class 11^{th} [physics (Term-2)]

1 .What are the basic assumptions of kinetic theory of gases? on their basis, derive an expression for the pressure exerted by an ideal gas.

2. What is meant by degrees of freedom? State the law of equipartition of energy. Hence calculate the values of molar specific heats at constant volume and pressure for monoatomic, diatomic and triatomic gases.

3. Calculate the kinetic energy of one mole of argon at 127^oC. given that N =6.02×10^{23} mol and k=1.381 $x10^{-23}$ $mol^{-1}K^{-1}$

4.Calculate the number of degrees of freedom for one mole of diatomic gas at N.T.P

5.Calculate the number of degrees of freedom of 1 cm^3 of helium gas at N.T.P.

6.A vessel contains argon gas at 127^oC. find the average kinetic energy of argon molecule, if Boltzmann's constant, k=1.38 x 10^{-23} j mol^{-1} K^{-1} .

7.Calculate the total kinetic energy of 1g of helium at 27^oC Given that R =8.31 $mole^{-1}$ K^{-1}.

8.At what temperature is the r.m.s velocity of a hydrogen molecule equal to that of a oxygen molecule at 47^oC ?

9.Give the kinetic interpretation of temperature and define absolute temperature.

10.If three molecules have velocities 0.5,1 and 2km s^{-1} respectively, calculate the relation between the root mean square speed and average speed.

11. Calculate the temperature at which the r.m.s velocity of a hydrogen will be equal to 8km/hr. given that R =8.31 j $mole^{-1}$.

12. Calculate the r.m.s velocity of CO_2 molecules at N.T.P. given, R=8.31 j mol^{-1} K^{-1} .

13. Calculate the r.m.s velocity of hydrogen at N.T.P. given that density of the gas is $9x10^{-5}$ g cm^{-3}.

14.Find the temperature at which the root mean square velocity of a gas is double than that its value at 0 ^oC , pressure remaining constant.

15. The molar gas volume at S.T.P. is 22.4 litre and Avogadro number is $6.023x10^{23}$. (a) calculate the number of gas molecules per unit volume,

16. Draw a graph to show the variation of V^2_{rms} with absolute temperature .

17. When an ideal gas undergoes an isothermal expansion, the pressure of the gas in the encloser falls. Why?

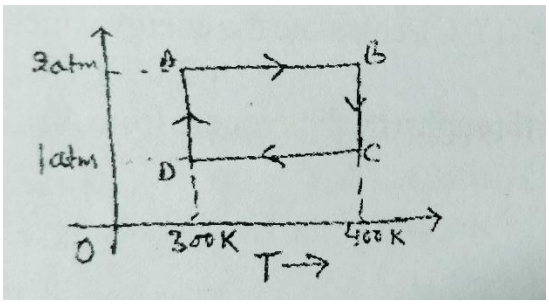
18. Two identical cylinders contains helium at 2.5 atmosphere and organ at 1 atmosphere. Find pressure if both the gases are filled in one of the cylinders?

19. The temperature of argon, kept in vessel, is raised by 1^oC at constant volume. The total heat supplied to the gas is a combination of translational energies. Find their respective shares.

20. A gas mixture consist of 2moles of oxygen and 4 moles of argon at temperature T. find total internal energy of the system, when vibrational modes are rejected.

21.During an adiabatic process, the pressure of a gas is found to be proportional to cube of its absolute temperature what is the ratio of Cp/Cv ?

22. Two moles of helium gas undergo a cyclic process as shown in fig. assuming the gas to be ideal calculate the following quantities in the prosses (a) the net work done (b) the net change in internal energy (c) the net change heat energy. (R=8.32j/mole)



23. State and explain the isothermal process, derive the expression for work done in isothermal process.

24. State and explain the adiabatic process, derive the expression for work done in adiabatic process.

25. State and explain first law of thermodynamics. Establish the relation between two principle specific heats of a gas on the basis of this law. And explain that $C_P > C_V$ .And write the limitations of first law of thermodynamics .

26. Show that an adiabatic curve is always steeper than an isothermal curve.

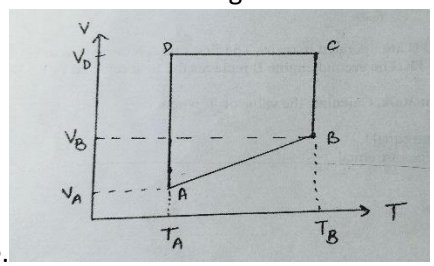
27. In adiabatic process show that PV^{γ}=constant.

28. State the following (i) Thermodynamic equilibrium(ii)zeroth law of thermodynamics(iii) first law of thermodynamics (iv) second law of thermodynamics(a) Kelvin-plank's statement(b) Clausius statement.

29. What is the specific heat of gas in an Isothermal process?

30. A refrigerator has two transfer an average of 263 j of heat per second from temperature 10^oC to 25^oC. calculate the average power consumed, assuming no energy losses in the process.

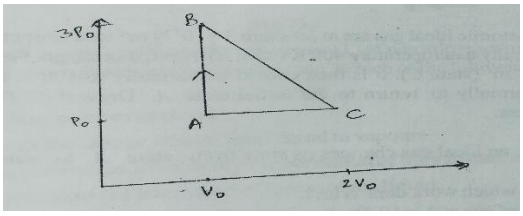
31. A mono atomic ideal gas of two moles is taken through a cyclic process from A as shown in the figure.



The volume of ratio are $V_B/V_A=2$ and $V_D/V_A= 4$. If temperature T_A at A is 27^oC calculate

(a) The temperature of the gas at point B
(b) Heat absorbed or released by the gas in each process.
(c) The total work done by the gas during the complete cycle.
give your answer in terms of R

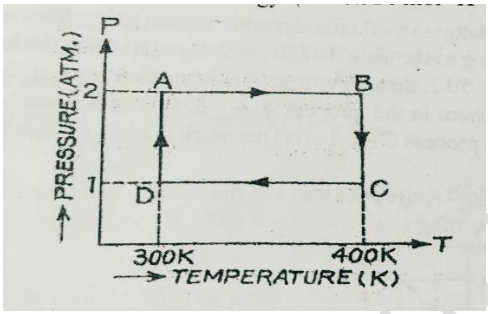
34.One mole of an ideal monoatomic gas is taken the cyclic process ABCA as shown in fig.



Calculate,

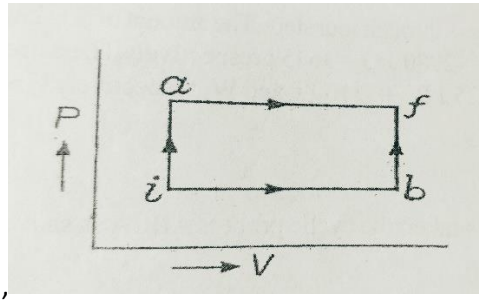
(i) The work done by the gas
(ii) The heat rejected by the gas in the path CA and heat absorbed by the gas in the path AB.
(iii) The net heat absorbed by the gas in the path BC
(iv) The maximum temperature attained by the gas during the cycle.

35. Two moles of helium gas undergo a cyclic process as shown in fig .



assuming the gas to be ideal, calculate the following quantities in this process:

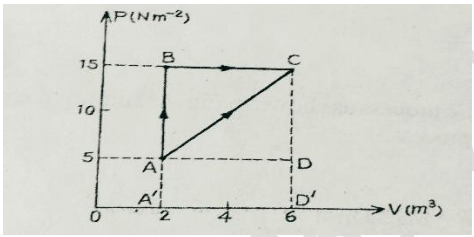
(a) The net change in the heat energy.
(b) The net work done.
(c) The net change in internal energy.



36. In the given figure ,
the initial and final states of a gas are shown by points *i* and *f* at i and b & the internal energies of the gas are 10 and 22 j respectively. For the path *iaf* , dQ =50 j and 20 j of for P. the path *ibf*, dQ =36 then find out the following :

i) Internal energy of the gas at f,
ii) Value of *dW* for the path *ibf*,
iii) Value of *dW* for the path ia,
iv) Value of dQ for the path bf,
v) Values of dU and dW for the path ib.

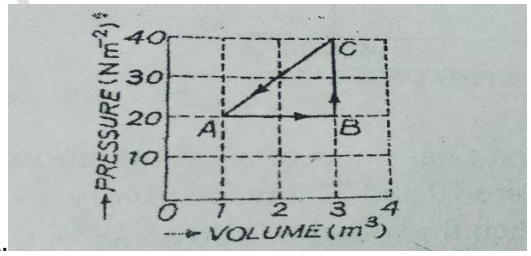
37. 4 moles of a monoatomic ideal gas are at pressure 3×10^5 N m^{-2} and temperature 100 K (state ,A). it is heated isobarically to temperature 400K (state B). next it undergoes isothermal expansion to pressure 1×10^5 N m^2 (state C). it is then cooled isobarically to 100 K (state D). finally, it is compressed isothermally to return to the initial state A. draw P-T ,P-V and V-T diagrams for the whole process.



38. In the given figure,
an ideal gas changes its state from state A to state C by two paths ABC and AC.

(i) Find, the path along which work done is less.
(ii) The internal energy of gas at A is 10 j and amount of heat supplied to change its state to C through the path AC is 200 J. calculate its internal energy at C.
(iii) The internal of gas at state B is 20 j. find the amount of heat supplied to the gas to go from A to B,

39. The adjacent figure shows the changes in a thermodynamics system going from an initial state A to the states B and C and returning to the state A.



if U_A =0, U_B 30j and the heat given to the system in the process B—> C =50j, then determine : (i) internal energy of the system in the state C, (ii) heat given to the system in the process A—>B, (iii) heat given to the system or taken out from the system in the process C—>A, (iv) net work done in complete cycle .

40. What is meant by symmetric & Doppler effect?

41. Tube a has both ends open, whole tube B has one end closed otherwise the two tubes are identical. what is the ratio of fundamental frequency of the tubes A and B?

42. A policeman on duty detects a drop of 15% in the pitch of the horn of a motor car as it crosses him, if the velocity of sound is 330m/s, calculate the speed of the car.

43. The third overtone of a closed organ pipe is found to be in unison with the first overtone of an open pipe. Find the ratio of the length of the pipes.

44. Two waves of the same frequency and amplitude superpose to produce a resultant disturbance of the same frequency. What is the phase difference between the waves?

45. A pendulum clock is taken to lift moving down with a uniform velocity. Will it gain or lose time?

46. What is the phase difference between displacement and velocity of the particle executing S.H.M.?

47. The potential energy of a particle is S.H.M. varies periodically. If 'v'is the frequency of oscillation of the particle then what is the frequency of variation of potential energy?

48. At what positions, the tension in the string of a simple pendulum is (i) maximum and (ii) minimum?

49. A body executing S.H.M. has a velocity of 4m/s at a distance of 3m from mean position and 3m/s at a distance of 4m from the mean position. Find the amplitude and the period of the motion.

50. The S.H.M. of particle is given by the equation $y=3\sin\omega t+4\cos\omega t$ find its amplitude

51. The length of a simple pendulum executing simple harmonic motion is increased by 20%. What is the percentage increase in the time period of the pendulum?

52. Two successive resonance frequencies in a open pipe 1944Hz and 259Hz. Find the length of the tube. The speed of sound in air is 324m/s.

53. Derive an expression for the total energy of a particle executing S.H.M.

54. What is simple pendulum? Show that the motion of a pendulum is S.H.M. and hence deduce an expression for the time period of pendulum.

55. Discus the effect of the following factors on the velocity of sound

(i) Change in pressure
(ii) Change in density
(iii) Change in temperature

56. What are the stationary waves. Obtain the equation of the stationary wave formed when a progressive wave is reflected at

(i) The rigid boundary
(ii) The open boundary

57. A particle executes simple harmonic motion under the restoring force provided by a spring. The time period is T. if the spring is divided in n equal parts and one part is used to continue the simple harmonic motion, what will be its time period.?

58. The shortest distance travelled by a particle executing S.H.M from mean position in 2 second is $\sqrt{3}/2$ times its amplitude. Determine its time period.

59. Two waves of angular frequency 50 and 5000 rad/s have the same displacement and the amplitude, 3×10^{-5} cm. deduce the acceleration amplitude for them.

60. Discuss the Newton's formula for velocity of sound and what correction made by the Laplace ? Explain.

61. What is beats ? Find the beats frequency.

62. Find the expression for the frequency of sound in (a) open organ pipe and (b) closed organ pipe .

63. Find the expression of the velocity of wave in a stretched string .

64.Define Poisson's ratio? Does it have any unit?

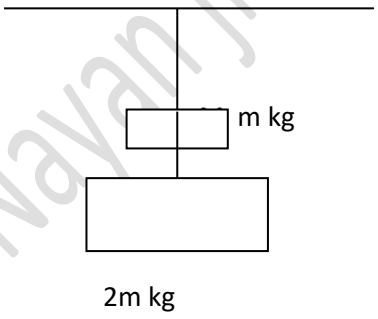
66. What is elastic fatigue?

67.Explain why detergents should have small angle of contact?

68. Prove that the elastic potential energy per unit volume is equal to half x stress x strain.

69. Which is more elastic steel or rubber. Explain.

70. Two wires P and Q of same diameters are noted as shown in the figure. The length of wire P is L *m* and its young's modulus is Y N/m^2 while length of wire *a* is twice that of P and its material has young's modulus half that of P. Compute the ratio of their elongation.



71. Define surface tension and surface energy. Obtain a relation between them.

72. State and prove Torricelli's theorem for efflux.

73. Using dimensional method obtained, Stoke's law expression for viscous force $F = 6 \pi \eta a v$.

74. State Pascal's law for fluids with the help of a neat labelled diagram explain the principle and working of hydraulic brakes.

75. Define Capillarity and angle of contact. Derive an expression for the ascent of a liquid in a capillary tube.

76. Give the principle of working of venturimeter. Obtain an expression for volume of liquid following through the tube per second.

77. A liquid drop of diameter D breaks up into 27 tiny drops. Find the resulting change in energy. Take surface tension of liquid as σ.

78. Define the coefficients of linear expansion. Deduce relation between it and coefficient of superficial expansion and volume expansion.

79. Explain why:

(a) a body with large reflectivity is a poor emitter.

(b) a brass tumbler feels much colder than a wooden tray on a chilly day.

80. Draw a graph show the anomalous behavior of water. Explain its importance for sustaining life under water.

81. Define (i) Specific heat capacity (ii) Heat capacity (iii) Molar specific heat capacity at constant pressure and at constant volume and write their units.

82. Define coefficient of thermal conductivity. Two metal slabs of the same area of cross-section, thickness d_1 and d_2 having thermal conductivities K_1 and K_2 respectively are kept in contact. Deduce expression for equivalent thermal conductivity.

83. Draw and discuss stress versus strain graph, explaining clearly the terms elastic limit, permanent set, proportionality limit, elastic hysteresis, tensible strength.

84. State and prove Bernoullis theorem. Give its limitation. Name any two application of the principle.

85. Define terminal velocity. Obtain an expression for terminal velocity of a sphere falling through a viscous liquid. Use the formula to explain the observed rise of air bubbles in a liquid.

86. On what factors does the rate of heat conduction in a metallic rod in the steady state depend. Write the necessary expression and hence define the coefficient of thermal conductivity. Right its unit and dimensions.

87. Show graphically how the energy emitted from a hot body varies with the wavelength of radiation. Give some of salient points of the graph.

88. State and prove Pascal's law of transmission of fluid pressure. Explain how is Pascal's law applied in a hydraulic lift.

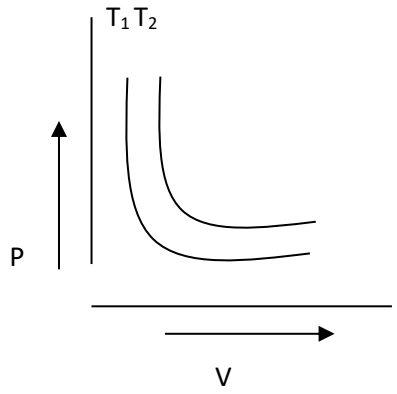
89. - Discuss energy distribution of black body radiation spectrum and explain Wein's displacement law of radiation and Stefan's law of heat radiation.

90. How much volume does one mole of a gas occupy at STP?

91. State Avogadro's law. Deduce it on the basis of Kinetic theory of gases.

92. The ratio of specific heat capacity at constant pressure to the specific heat capacity at constant volume of a diatomic gas decreases with increase in temperature. Explain.

93. Isothermal curves for a given mass of gas are shown at two different temperatures T_1 and T_2 state whether $T_1 > T_2$ or $T_2 > T_1$ justify your answer.



94. State Grahm's law of diffusion. How do you obtain this form Kinetic theory of gases.

95. What are the basic assumptions of kinetic theory of gases? On their basis derive an expression for the pressure exerted by an ideal gas.

96. What is law of equipartition of energy? Find the value of $\gamma = C_p/C_v$ for diatomic and monatomic gas. Where symbol have usual meaning.

97. One mole of a monoatomic gas is mixed with three moles of a diatomic gas. What is the molecular specific heat of the mixture at constant volume?

Take R = 8.31/mole^{-1} K^{-1}.

98. At what temperature the r.m.s speed of oxygen atom equal to r.m.s. speed of helium gas atom at -10°C?

Atomic mass of helium = 4

Atomic mass of oxygen = 32