Atomic Energy Central School No. 4 Rawatbhata

Multiple Choice Question Examination (October 2019)

ClassXI (PCM) Subjects:Physics, Chemistry and Mathematics MM: 120

Name:______________________________________ Class/Sec: ___________

OMR Roll No:_________________Invigilator's Sign:_____________________

Instruction: 1) Fill & darken roll number field correctly on OMR Sheet. In case of any error, OMR Answer Sheet will be not be read by the OMR Scanner.

2) Darken the most suitable option no. on OMR Answer Sheet.

3) There is no negative marking.

Physics

1. The scalar product of two vectors A and B in terms of the projections of the vectors on the x, y and z axis is **1**

a) $\mathbf{AB} = A_xB_x + A_yB_y + A_zB_z$

b) $\mathbf{AB} = A_xB_x - A_yB_y - A_zB_z$

c) $\mathbf{AB} = A_xB_x - A_yB_y + A_zB_z$

d) $\mathbf{AB} = A_xB_x + A_yB_y - A_zB_z$

2. How many joules of energy does a 100-watt light bulb use per hour? How fast would a 70-kg person have to run to have that amount of kinetic energy? **1**

a) 360000 J, 101 m/s

b) 320000 J, 130 m/s

c) 380000 J, 120 m/s

d) 340000 J, 140 m/s

3. In which case is the work done zero? **1**

a) Force and displacement are perpendicular to each other

b) Force and displacement are in the same direction

c) Force and displacement are at an angle of 45°

d) Force and displacement are at an angle of 75°

4. A 6.0-kg box moving at 3.0 m/s on a horizontal, frictionless surface runs into a light spring of force constant 75 N/cm Use the work–energy theorem to find the maximum compression of the spring. **1**

a) 7.5 cm

b) 8.5 cm

c) 9.5 cm

d) 6.5 cm

5. A trolley of mass 200 kg moves with a uniform speed of 36 km/h on a frictionless track. A child of mass 20 kg runs on the trolley from one end to the other (10 m away) with a speed of 4 m s^{-1} relative to the trolley in a direction opposite to the its motion, and jumps out of the trolley. What is the final speed of the trolley? **1**

a) 11.36 m/s

b) 8.13 m/s

c) 10.36 m/s

d) 9.36 m/s

6. A person trying to lose weight (dieter) lifts a 10 kg mass, one thousand times, to a height of 0.5 m each time. Assume that the potential energy lost each time she lowers the mass is dissipated. Fat supplies 3.8×10^7 J of energy per kilogram which is converted to mechanical energy with a 20% efficiency rate. How much fat will the dieter use up? **1**

a) 8.85×10^{-3} kg

b) 8.45×10^{-3} kg

c) 7.45×10^{-3} kg

d) 6.45×10^{-3} kg

7. Two billiard balls each with a mass of 150g collide head-on in an elastic collision. Ball 1 was travelling at a speed of 2 m /s and ball 2 at a speed of 1.5 m /s. After the collision, ball 1 travels away from ball 2 at a velocity of 1.5 m /s .What is the velocity of ball 2? **1**

a) ball 2 moves with a velocity of 3.5 m/s

b) ball 2 moves with a velocity of 2 m /s

c) ball 2 moves with a velocity of 2.5 m /s

d) ball 2 moves with a velocity of 3.7 m/s

8. A12-pack of Omni-Cola (mass 4.30 kg) is initially at rest on a horizontal floor. It is then pushed in a straight line for 1.20 m by a trained dog that exerts a horizontal force with magnitude 36.0 N. Use the work–energy theorem to find the final speed of the 12-pack if the coefficient of kinetic friction between the 12-pack and the floor is 0.30. **1**

a) 3.81 m/s

b) 4.01 m/s

c) 3.61 m/s

d) 4.22 m/s

9. In which of the following cases is the work done positive? **1**

a) Work done by gravitational force while a man in lifts a bucket out of a well by means of a rope tied to the bucket
b) Work done by friction on a body sliding down an inclined plane
c) Work done by the resistive force of air on a vibrating pendulum in bringing it to rest.
d) work done by an applied force on a body moving on a rough horizontal plane with uniform velocity

10. The work done by the force is defined to be **1**

a) the product of component of the force in the direction of the displacement and the magnitude of the displacement
b) the product of component of the force in the direction perpendicular to displacement and the magnitude of the displacement
c) the negative product of component of the force in the direction of the displacement and the magnitude of this displacement
d) the product of force and the magnitude of the displacement

11. A 50.0-kg marathon runner runs up the stairs to the top of a 443-m-tall Tower. To lift herself to the top in 15.0 minutes, what must be her average power output? **1**

a) 261 W
b) 221 W
c) 201 W
d) 241 W

12. The Sun converts an enormous amount of matter to energy. Each second, 4.19×10^9 kg—approximately the capacity of 400 average-sized cargo ships—is changed to energy. What is the power output of the Sun? **1**

a) 1.57×10^{26} W
b) 3.77×10^{26} W
c) 2.62×10^{26} W
d) 0.72×10^{26} W

13. A sled with mass 8.00 kg moves in a straight line on a frictionless horizontal surface. At one point in its path, its speed is 4.00 m/s; after it has traveled 2.50 m beyond this point, its speed is 6.00 m/s. Use the work–energy theorem to find the force acting on the sled, assuming that this force is constant and that it acts in the direction of the sled's motion. **1**

a) 30.0 N
b) 32.0 N
c) 28.0 N
d) 34.0 N

14. The total mechanical energy of a system is conserved if the **1**

a) forces, doing work on it, are not conservative
b) forces, doing work on it, are damped
c) forces, doing work on it, are conservative
d) forces, doing work on it, are viscous

15. In a graph of F(x) vs x, the area under the curve **1**

a) represents energy of F(x).
b) represents work done by F(x).
c) represents the impulse of F(x)
d) represents the momentum of F(x).

16. Adult cheetahs, the fastest of the great cats, have a mass of about 70 kg and have been clocked running at up to 72 mph (32 m/s) How many joules of kinetic energy does such a swift cheetah have? **1**

a) 34,000 J
b) 32,000 J
c) 29,000 J
d) 35840 J

17. Consider the collision of two cars. Car 1 is at rest and Car 2 is moving at a speed of 2 m /s in the negative x-direction. Both cars each have a mass of 500 kg. The cars collide inelastically and stick together. What is the resulting velocity of the resulting mass of metal? **1**

a) 1.4 m /s to the left
b) 1 m /s to the left.
c) 1.2 m /s to the left
d) 1.5 m /s to the left

18. For a ball dropped from a tower of height h the total mechanical energy is **1**

a) the difference of potential and kinetic energies
b) the potential energy
c) the sum of potential and kinetic energies
d) the kinetic energy

19. A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3 in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump? **1**

a) 33.6 kW
b) 45.2 kW
c) 38.3 kW
d) 43.3 kW

20. A 3.00-kg crate slides down a ramp. The ramp is 1.00 m in length and inclined at an angle of 30.0° . The crate starts from rest at the top, experiences a constant frictional force of magnitude 5.00 N, and continues to move a short distance on the flat floor after it leaves the ramp. Use energy methods to determine the speed of the crate at the bottom of the ramp. **1**

a) 2.78 m/s
b) 2.54 m/s
c) 2.25 m/s
d) 1.76 m/s

21. If F is a force and d is the displacement in the direction of force then the work done by the force is given by **1**

a) 2F.d
b) - F.d
c) F.d
d) -2F.d

22. The S.I unit of force is **1**

a) Joule
b) dyne
c) Newton
d) erg

23. A 0.800-kg ball is tied to the end of a string 1.60 m long and swung in a vertical circle. Calculate the total work done on the ball by (i) the tension in the string and (ii) gravity for motion along the semicircle from the lowest to the highest point on the path. **1**

a) 0, -281 J
b) 0, -251 J
c) 0, -2.51 J
d) 0, -25.1 J

24. The scalar product of two vectors A and B is **1**

a) a tensor
b) vector
c) a scalar
d) a complex number

25. Physically, the notion of potential energy is applicable only to **1**

a) The class of forces where work done against the force gets converted to thermal energy
b) The class of forces where work done against the force gets dissipated
c) The class of forces where work done against the force gets converted to kinetic energy
d) The class of forces where work done against the force gets stored up as energy.

26. A body of mass 0.5 kg travels in a straight line with velocity v =a $\mathbf{x}^{3/2}$ where a = 5 $\mathbf{m}^{-1/2}\mathbf{s}^{-1}$. What is the work done by the net force during its displacement from x = 0 to x = 2 m? **1**

a) 50 J
b) 30 J
c) 40 J
d) 60 J

27. A trolley of mass 200 kg moves with a uniform speed of 36 km/h on a frictionless track. A child of mass 20 kg runs on the trolley from one end to the other (10 m away) with a speed of 4 m s^{-1} relative to the trolley in a direction opposite to the its motion, and jumps out of the trolley. How much has the trolley moved from the time the child begins to run? **1**

a) 25.9 m
b) 23.3 m
c) 27.8 m
d) 24.1 m

28. The work done by a conservative force **1**

a) depends on both the end points as well as the path
b) depends on the path
c) depends only on the end points
d) depends only on the end point and the path

29. The bob of a pendulum is released from a horizontal position. If the length of the pendulum is 1.5 m, what is the speed with which the bob arrives at the lowermost point, given that it dissipated 5% of its initial energy against air resistance? **1**

a) 5.5 m/s
b) 4.7 m/s
c) 5.3 m/s
d) 4.9 m/s

30. work-energy theorem does not give information on **1**

a) work done
b) time dependence
c) difference of kinetic energies
d) change in kinetic energy

31. Consider two 2 marbles. Marble 1 has mass 100 g and marble 2 has mass 50 g. Edward rolls marble 1 along the ground towards marble 2 in the positive x-direction. Marble 2 is initially at rest and marble 1 has a velocity of 3 m /s in the positive x-direction. After they collide elastically, both marbles are moving. What is the final velocity of each marble? **1**

a) ball 1 moves to the right at 3 m /s and ball 2 moves to the left with a velocity of 2m /s

b) ball 1 moves to the right at 5 m /s and ball 2 moves to the left with a velocity of 3m /s

c) ball 1 moves to the right at 2 m /s and ball 2 moves to the left with a velocity of 2m /s

d) ball 1 moves to the right with a velocity of 1m/s and ball 2 also moves to the right at 4 m/s

32. A bolt of mass 0.3 kg falls from the ceiling of an elevator moving down with an uniform speed of 7 m/s. It hits the floor of the elevator (length of the elevator = 3 m) and does not rebound. What is the heat produced by the impact? **1**

a) 9.22 J
b) 8.42 J
c) 8.82 J
d) 8.11 J

33. A12-pack of Omni-Cola (mass 4.30 kg) is initially at rest on a horizontal floor. It is then pushed in a straight line for 1.20 m by a trained dog that exerts a horizontal force with magnitude 36.0 N. Use the work–energy theorem to find the final speed of the 12-pack if there is no friction between the 12-pack and the floor **1**

a) 4.38 m/s
b) 4.58 m/s
c) 4.48 m/s
d) 4.68 m/s

34. The launching mechanism of a toy gun consists of a spring of unknown spring constant. When the spring is compressed 0.120 m, the gun, when fired vertically, is able to launch a 35.0-g projectile to a maximum height of 20.0 m above the position of the projectile before firing. Neglecting all resistive forces, determine the spring constant. **1**

a) 873 N/m
b) 993 N/m
c) 903 N/m
d) 953 N/m

35. A tandem (two-person) bicycle team must overcome a force of 165 N to maintain a speed of 9.00 m/s. Find the power required per rider, assuming that each contributes equally. **1**

a) 742.5 W
b) 765 W
c) 798 W
d) 702 W

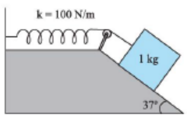
36. A person trying to lose weight (dieter) lifts a 10 kg mass, one thousand times, to a height of 0.5 m each time. Assume that the potential energy lost each time she lowers the mass is dissipated. How much work does she do against the gravitational force? **1**

a) 49000 J
b) 55000 J
c) 59000 J
d) 45000 J

37. A pump is required to lift 800 kg of water per minute from a well 14.0 m deep and eject it with a speed of 18.0 m/s. How much work is done per minute in lifting the water? **1**

a) 1.10×10^5 J
b) 1.40×10^5 J
c) 1.30×10^5 J
d) 1.20×10^5 J

38. A 1 kg block situated on a rough incline is connected to a spring of spring constant 100 N m^{-1} as shown in Figure. The block is released from rest with the spring in the unstretched position. The block moves 10 cm down the incline before coming to rest. Find the coefficient of friction between the block and the incline. Assume that the spring has a negligible mass and the pulley is frictionless. **1**



a) 0.115
b) 0.3
c) 0.07
d) 0.25

39. A 75.0-kg painter climbs a ladder that is 2.75 m long leaning against a vertical wall. The ladder makes an angle of 30° angle with the wall. How much work does gravity do on the painter? **1**

a) -1950 J
b) -1850 J
c) -2050 J
d) -1750 J

40. A block having a mass of 0.80 kg is given an initial velocity 1.2 m/s to the right and collides with a spring of negligible mass and force constant k =50 N/m. Assuming the surface to be frictionless, calculate the maximum compression of the spring after the collision. **1**

a) 0.15 m
b) 0.20 m
c) 0.10 m
d) 0.25 m

41. Calculate the total number of electrons present in 1.4 g of dinitrogen gas. **1**

a) 4.4521×10^{23} electrons
b) 4.2154×10^{23} electrons
c) 5.0832×10^{23} electrons
d) 4.6329×10^{23} electrons

42. In Van der Waal's equation of state for a non-ideal gas the net force of attraction among the molecules is given by **1**

a) $P - \frac{an^2}{V^2}$
b) $-\frac{an^2}{V^2}$
c) $\frac{an^2}{V^2}$
d) $P + \frac{an^2}{V^2}$

43. 34.05 mL of phosphorus vapour weighs 0.0625 g at 546 C and 0.1 bar pressure. What is the molar mass of phosphorus? **1**

a) 1247.7 g/mol
b) 1325.9 g/mol
c) 1097.6 g/mol
d) 1120.3 g/mol

44. under which of the following two conditions, a gas deviates most from the ideal behavior? **1**

a) Low temperature only
b) High temperature and Low pressure
c) Low pressure only
d) High pressure and Low temperature

45. Which of the following property of water can be used to explain the spherical shape of rain droplets? **1**

a) critical phenomena
b) viscosity
c) surface tension
d) pressure

46. The three states of matter of 2O are in equilibrium at **1**

a) critical point.
b) steam point.
c) the triple point.
d) ice point.

47. With rise in temperature, the surface tension of a liquid **1**

a) Remaining the same
b) Decreases
c) Increases
d) None of these

48. How does the surface tension of a liquid vary with increase in temperature? **1**

a) Increases
b) Decreases
c) No regular pattern is followed
d) Remains same

49. Water has high surface tension and high capillarity because of **1**

a) dispersion forces.
b) hydrogen bonds.
c) ionic bonds.
d) covalent bonds.

50. CO can be easily liquified and even solidified because **1**

a) It has weak forces of attraction
b) It has comparatively more force of attraction than other gases
c) It has more intermolecular space
d) It is present in atmosphere

51. The average kinetic energy of the gas molecule is **1**

a) Inversely proportional to its absolute temperature
b) Equal to the square of its absolute temperature
c) All of these
d) Directly proportional to its absolute temperature

52. Dipole-dipole forces act between the molecules possessing permanent dipole. Ends of dipoles possess 'partial charges'. The partial charge is **1**

a) more than unit electronic charge
b) less than unit electronic charge
c) double the unit electronic charge
d) equal to unit electronic charge

53. At $^{\circ}C$, the density of a certain oxide of a gas at 2 bar is same as that of dinitrogen at 5 bar. What is the molecular mass of the oxide? **1**

a) 270 g/mol
b) 70 g/mol
c) 90 g/mol
d) 170 g/mol

54. Which of the following statements about Hydrogen bond incorrect? **1**

a) In hydrogen bonding H atom becomes partially negative and is attracted to the more positive N atom.
b) In hydrogen bonding H atom becomes partially positive and is attracted to the more negative N atom.
c) In hydrogen bonding H atom becomes partially positive and is attracted to the more negative O atom.
d) In hydrogen bonding H atom becomes partially positive and is attracted to the more negative F atom.

55. At constant temperature, the pressure of the gas is reduced to one third, the volume **1**

a) Remaining the same
b) Cannot be predicted
c) Increases by three times
d) Reduce to one third

56. Which of the following is the correct mathematical relation for Charles law at constant pressure? **1**

a) $V \alpha n$
b) V is independent of T
c) $V \alpha T$
d) $V \alpha \frac{1}{T}$

57. What will be the pressure exerted by a mixture of 3.2 g of methane and 4.4 g of carbon dioxide contained in a 9 m^3 flask at $27\ ^{\circ}C$? **1**

a) 8.314×10^4 Pa
b) 6.224×10^4 Pa
c) 9.313×10^4 Pa
d) 7.452×10^4 Pa

58. Gay Lussac's law states that at constant volume, pressure of a fixed amount of a gas ? **1**

a) Varies inversely with the temperature.
b) Varies directly with the temperature
c) Constant irrespective of its absolute temperature.
d) Directly proportional to square of absolute temperature.

59. The compressibility factor, z for an ideal gas is **1**

a) Equal to one
b) Zero
c) Less than one
d) Greater than one

60. A mixture of dihydrogen and dioxygen at one bar pressure contains 20% by weight of dihydrogen. Calculate the partial pressure of dihydrogen. **1**

a) 0.97 bar
b) 1.12 bar
c) 0.65 bar
d) 0.8 bar

61. The entropy change can be calculated by using the expression $\Delta S = \frac{q_{rev}}{T}$ When water freezes in a glass beaker, choose the correct statement amongst the following : **1**

a) ΔS (system) decreases and ΔS (surroundings) also decreases.
b) ΔS (system) decreases but ΔS (surroundings) increases.
c) ΔS (system) decreases but ΔS (surroundings) remains the same.
d) ΔS (system) increases but ΔS (surroundings) decreases.

62. An isochoric process takes place at constant **1**

a) temperature
b) pressure
c) volume
d) concentration

63. For the process, H O (l) + 40.7 kJ H_2O (g) ,select the correct statement: **1**

a) $\Delta H < 0$ hence process is endothermic
b) $\Delta H > 0$ hence process is exothermic
c) $\Delta H < 0$ hence process is exothermic
d) $\Delta H > 0$ hence process is endothermic

64. Which of the following statement is not correct? **1**

a) ΔG is positive for a non-spontaneous reaction
b) ΔG is zero for a reaction at equilibrium
c) ΔG is positive for a spontaneous reaction
d) ΔG is negative for a spontaneous reaction

65. Which one is the correct unit for entropy? **1**

a) JK^{-1} mol
b) kJ mol
c) JK^{-1} mol^{-1}
d) KJ mol^{-1}

66. During complete combustion of one mole of butane, 2658 kJ of heat is released. The thermochemical reaction for above change is **1**

a) $C_4H_{10}(g) + O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)\ \Delta_cH = -1329.0\ kJ\ mol^{-1}$
b) $2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)\ \Delta_cH = -2658.0\ kJ$
c) $C_4H_{10}(g) + O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)\ \Delta_cH = -2658.0\ kJ\ mol^{-1}$
d) $C_4H_{10}(g) + \frac{13}{2}O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)\ \Delta_cH = +2658.0\ kJ\ mol^{-}$

67. For the reaction at 298 K, $A + B \rightarrow C$, $\Delta H = 400\ kJ\ mol^{-1}$ and $\Delta S = 0.2\ kJ\ K^{-1} mol^{-1}$ .At what temperature will the reaction become spontaneous considering ΔH and ΔS to be constant over the temperature range. **1**

a) 3500 K
b) 2000 K
c) 1500 K
d) 2500 K

68. Thermodynamics is not concerned about **1**

a) energy changes involved in a chemical reaction.
b) the rate at which a reaction proceeds.
c) the feasibility of a chemical reaction.
d) the extent to which a chemical reaction proceeds.

69. A reaction, A+B $\rightarrow$ C+D+q is found to have a positive entropy change reaction will be: **1**

a) spontaneous at high temperature
b) spontaneous only at low temperature
c) spontaneous at all temperature
d) nonspontaneous at all temperature

70. Which of the following relationship is true? **1**

a) $C_p = C_v$
b) $C_p > C_v$
c) $C_p = C_v = 0$
d) $C_v > C_p$

71. Enthalpies of formation of CO(g), $O_2(g)$, $N_2O(g)$ and $N_2O_4(g)$ are -110, –393, 81 and 9.7 kJ mol^{-1} respectively. Find the value of Δ_rH for the reaction: $N_2O_4(g) + 3CO(g) \rightarrow N_2O(g) + 3CO_2(g)$ **1**

a) - 850 kJ
b) -600 kJ
c) -778 kJ
d) -802 kJ

72. Enthalpy of sublimation of a substance is equal to **1**

a) enthalpy of fusion
b) enthalpy of fusion + enthalpy of vapourisation
c) twice the enthalpy of vapourisation
d) enthalpy of vapourisation

73. For the process to occur under adiabatic conditions, the correct condition is: **1**

a) q = 0
b) $\triangle T = 0$
c) $\triangle p = 0$
d) w = 0

74. The standard enthalpies for formation of elements in their reference states are taken as zero. The standard molar enthalpy of formation of a compound **1**

a) is never negative
b) may be positive or negative
c) is always negative
d) is always positive

75. Which of the following property is not a state function? **1**

a) Work
b) enthalpy
c) internal energy
d) entropy

76. Standard Molar Enthalpy of Formation is the standard enthalpy change for the formation of - **1**

a) one mole of a compound from its elements in their most stable states of aggregation.
b) one kg of a compound from its elements in their most stable states of aggregation.
c) one mole of a compound from its elements in at a pressure of 2 bar and 25° C.
d) one mole of a compound from its elements in at a pressure of 10 bar and 30° C.

77. The bond enthalpy depends on: **1**

a) electronegativity
b) all of these
c) bond length
d) size of the atom

78. The state of a gas constant can be described by quoting the relationship between **1**

a) temperature, amount, pressure
b) pressure, volume, temperature
c) amount, volume, temperature
d) pressure, volume, temperature, amount

79. Enthalpy of combustion of carbon to O_2 is 393.5 kJ mol^{-1}. Calculate the heat released upon formation of 35.2 g of CO_2 from carbon and dioxygen gas. **1**

a) -275 kJ
b) -375 kJ
c) -398 kJ
d) -315 kJ

80. For the process depicted by the equation: **1**
$H_2O\ (s) \longrightarrow H_2O\ (l)$

Δ H = + 1.43 kcal mol^{-1}. It represents:

a) Enthalpy of vaporization
b) Enthalpy of sublimation
c) Enthalpy of condensation
d) Enthalpy of fusion

Mathematics

81. The number of four digit numbers having atleast one digit as 7 is **1**

a) 3168
b) 5976
c) 1254
d) 9000

82. The number of all even divisors of 1600 is **1**

a) none of these
b) 21
c) 18
d) 3

83. The number of diagonals that can be drawn by joining the vertices of an octagon is : **1**

a) 12
b) 20
c) 28
d) 48

84. The greatest possible number of points of intersection of 8 straight lines and 4 circles is **1**

a) 32
b) 104
c) 128
d) 64

85. 4 boys and 4 girls are to be seated in a row. The number of ways in which this can be done, if the boys and girls sit alternately, is **1**

a) $4! \times 4!$
b) P(8,8)
c) none of these
d) $2 \times 4! \times 4!$

86. The total number of numbers from 1000 to 9999 (both inclusive) that do not have 4 different digits **1**

a) 9000
b) 4464
c) 4536
d) none of these.

87. A class is composed 2 brothers and 6 other boys. In how many ways can all the boys be seated at the round table so that the 2 brothers are not seated besides each other? **1**

a) 720
b) 1440
c) 3600
d) 4320

88. If P(n,r) = C(n,r) then **1**

a) r = 0 or 2
b) r = 1 or n
c) r = 0 or 1
d) n = r

89. 5 boys and 5 girls are to be seated around a table such that boys and girls sit alternately. The number of ways of seating them is **1**

a) $4! \times 4!$
b) $5! \times 4!$
c) $5! \times 2!$
d) $5! \times 5!$

90. The number of ways, in which a student can select one or more questions out of 12 each having an alternative, is **1**

a) 2^{12} b) 3^{12}
c) $3^{12}+1$ d) $3^{12}-1$

91. The total number of 4 digit odd numbers that can be formed using 0, 1, 2, 3, 5, and 7 are **1**

a) 375 b) 720
c) 400 d) 520

92. The number of five digit telephone numbers having atleast one of their digits repeated is **1**

a) 30240 b) 69760
c) 90000 d) 66500

93. The number of arrangements that can be formed by all the letters of the word "LAUGHTER "is **1**

a) 20160 b) 5040
c) 32768 d) 40320

94. Find r if $^{0}P_r = 2.^{9}P_r$ **1**

a) 6 b) 4
c) 3 d) 5

95. The number of all possible positive integral solutions of the equation xyz = 30 is **1**

a) 25 b) none of these
c) 27 d) 26

96. If $= 99^{50} + 100^{50}$ and $y = (101)^{50}$ then **1**

a) x < y b) x > y
c) x = y d) $x \geq y$

97. Find the middle term in the expansion of $\frac{x}{3} + 9y)^{10}$ **1**

a) $51030x^5y^5$ b) $17010x^5y^5$
c) $6804x^5y^5$ d) $61236x^5y^5$

98. The coefficient of ^{12} in the expansion of $\left(3 - \frac{x^3}{6}\right)^7$ is **1**

a) $\frac{32}{48}$ b) $\frac{17}{14}$
c) $\frac{35}{48}$ d) $\frac{35}{42}$

99. The coefficient of ^{5} in the expansion of $(1+x+x^2)^3$ is **1**

a) 3 b) 2
c) 5 d) 4

100. $\sqrt{5}+1)^4 + (\sqrt{5}-1)^4$ is **1**

a) an irrational number b) a negative real number
c) a rational number d) a negative integer

101$\sum_{r=0}^{n} 4^r.^nC_r$ is equal to **1**

a) 6^n b) 5^{-n}
c) 4^n d) 5^n

102. Find the coefficient of x in the expansion of $1-3x+7x^2)(1-x)^{16}$ **1**

a) 18 b) 19
c) -19 d) -18

103. $\sqrt{3}+1)^{2n} + (\sqrt{3}-1)^{2n}$ is **1**

a) negative real number b) an even positive integer
c) an odd positive integer d) irrational number

104. Find the middle term in the expansion of $\frac{2a}{3} - \frac{3}{2a})^6$ **1**

a) 18 b) -18
c) 20 d) -20

c) none of these d) $\sqrt{3}:1$

105.

Find a if the coefficient of x^2 and x^3 in the expansion of $(3+ax)^9$ are equal 1

a) $\frac{8}{5}$

b) $\frac{9}{5}$

c) $\frac{8}{7}$

d) $\frac{9}{7}$

106.

If the numbers a, b, c, d, e form an A.P. then the value of $a - 4b + 6c - 4d + e$ is 1

a) 1

b) 0

c) 2

d) none of these

107.

Two positive numbers are in the ratio $(2+\sqrt{3}) : (2-\sqrt{3})$. The ratio of their A.M. to G.M. is : 1

a) 1 : 2

b) 2 : 1

c) none of these

d) $\sqrt{3} : 1$

108. The first, second and last terms of an A.P. are a, b and 2 a. The number of terms in the A.P. is **1**

a) $\frac{b}{b-a}$ b) $\frac{a}{b-a}$

c) $\frac{a}{b+a}$ d) $\frac{b}{b+a}$

109. $f\frac{a+b\ x}{a-b\ x}=\frac{b+c\ x}{b-c\ x}=\frac{c+dx}{c-dx}, x\neq 0$,then a, b, c, d are in **1**

a) H.P. b) A.P.

c) none of these d) G.P.

110. The sum of first three terms of a G.P. is to the sum of next three terms is 125 : 27. The common ratio of the G.P. is **1**

a) $\frac{1}{2}$ b) $\frac{5}{3}$

c) $\frac{3}{5}$ d) none of these

111. The least n for which $+3+3^2+3^3+..........+3^{n-1}>1000$ is **1**

a) 7 b) none of these

c) 6 d) 8

112. The fourth term of a G. P. is 2, then product of first 7 terms is **1**

a) 32 b) 128

c) 64 d) 30

113. In a G.P. the ratio of the sum of first three terms to the sum of first six terms is 125 : 152. The common ratio of the G.P. is **1**

a) none of these b) 3.5

c) $\frac{5}{3}$ d) $\frac{3}{5}$

114. If $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$ be the arithmetic mean between two distinct positive reals a and b then the value of n is **1**

a) 1 b) -$\frac{1}{2}$

c) 0 d) $\frac{1}{2}$

115. The sum of first four terms of an A. P. is 56 and sum of last four terms is 112. If the first term is 11, then the number of terms is **1**

a) 12 b) none of these

c) 10 d) 11

116. If the numbers a, b, c are in A.P., b, c, d are in G.P. and c, d , e are in H.P., then a, c, e are in **1**

a) H.P. b) none of these

c) G.P. d) A.P.

117. An A.P. consists of n (odd) terms and its middle term is m. Then the sum of the A.P. is **1**

a) 2 mn b) $\frac{1}{2}mn$

c) mn^2 d) mn

118. The next term of the sequence 1, 1, 2, 4, 7, 13,.... Is **1**

a) 21 b) 24

c) none of these d) 19

119. The sum of first eight terms of a G.P. is 82 times the sum of first four terms. The common ratio of the G.P. is **1**

a) 3 b) 2

c) 5 d) 4

120. The sum of first 10 terms of a G.P. is equal to 244 times the sum of its first five terms. Then the common ratio is **1**

a) 7 b) 5

c) 4 d) 3

Solution

Class 11 - Physics

Multiple Choice Examination (October-2019)

Section A

1. (a)
$\mathbf{AB} = \mathrm{A_xB_x + A_yB_y + A_zB_z}$

Explanation:
A = A_x i+ A_y j+ A_zk
B = B_x i+ B_y j+ B_zk
A. B = (A_x i+ A_y j+ A_zk). (B_x i+ B_y j+ B_zk)
A. B = A_xB_x + A_yB_y + A_zB_z

2. (a)
360000 J, 101 m/s

Explanation:
$$P = \frac{Energy}{Time}$$
$$Energy = P \times Time = 100 \times 1Hr$$
$$Energy = 100 \times 1 \times 60 \times 60 = 360000J$$
for a 70 Kg man $K = \frac{1}{2}mv^2$
speed of man $v = \sqrt{\frac{2K}{m}} = \sqrt{\frac{2 \times 360000}{70}} = 101m/s$

3. (a)
Force and displacement are perpendicular to each other

Explanation:
Work done is given as
W = Fdcosθ
Here θ is the angle between F and d if both are perpendicular then θ = 90 degree so cosθ = 0 and thus work done is 0 .

4. (b)
8.5 cm

Explanation:
For maximum compression of spring kinetic energy will be converted into potential energy of spring.
$$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$$
$$x^2 = \frac{mv^2}{k} = \frac{6 \times 3 \times 3}{75 \times 10^2}$$
$$x = \sqrt{\frac{6 \times 3 \times 3}{75 \times 10^2}} = 0.085m = 8.5cm$$

5. (c)
10.36 m/s

Explanation:
Mass of troly M = 200Kg
mass of child m = 20Kg

speed of trolley v = 36Km/hr=36 x 5/18 = 10m/s
Let v' be the final velocity of the trolley with respect to the ground.
Final velocity of the boy with respect to the ground = $v' - 4$
from conservation of linear momentum

$$p_i = p_f$$
$$(M+m)v = Mv' + m(v' - 4)$$
$$(200+20) \times 10 = 200v' + 20(v' - 4)$$
$$2200 = 220v' - 80$$
$$v' = \frac{2280}{220} = 10.36m/s$$

6. (d)
6.45×10^{-3} kg

Explanation:
Work done by force applied against gravity for one lift will be
$W = Fs = mgh = 10 \times 9.8 \times 0.5 = 49J$
So work done for 1000 lifts = 49 x 1000 = 49000 J
efficiency = Work done / energy from fat
energy from fat used =Work done / efficiency
$E = \frac{W}{\eta} = \frac{49000}{0.2} = 245000J$
Energy from per kilogram fat = 3.8 $\times$ 10^7 J
Fat used $= \frac{245000}{3.8 \times 10^7} = 64473 \times 10^{-7} = 6.45 \times 10^{-3}Kg$

7. (b)
ball 2 moves with a velocity of 2 m /s

Explanation:
in elastic collision (e = 1) if mass of colliding bodies is same then their velocities after collision interchanged.

$$m_1 = 150gm$$
$$m_2 = 150gm$$
$$u_1 = 2m/s$$
$$u_2 = -1.5m/s$$
$$v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)u_1 + \left(\frac{2m_2}{m_1 + m_2}\right)u_2 = -u_2 = -1.5m/s$$
$$v_2 = \left(\frac{2m_1}{m_1 + m_2}\right)u_1 + \left(\frac{m_2 - m_1}{m_1 - m_2}\right)u_2 = u_1 = 2m/s$$

so that ball 2 moves with a velocity of 2 m /s

8. (c)
3.61 m/s

Explanation:

$$\Delta K = W$$
$$F = 36N$$
$$f = \mu R = \mu mg = 0.3 \times 4.3 \times 9.8 = 12.642N$$
$$F_{net} = F - f = 36 - 12.642 = 23.358N$$
$$s = 1.2m$$
$$\frac{1}{2}mv^2 - 0 = F_{net}s$$
$$\frac{1}{2} \times 4.3 \times v^2 = 23.358 \times 1.2$$
$$v^2 = \frac{23.358 \times 1.2 \times 2}{4.3} = 13.03$$
$$v = \sqrt{13.03} = 3.61m/s$$

9. (d)
work done by an applied force on a body moving on a rough horizontal plane with uniform velocity

Explanation:
When a body is moving on a rough horizontal surface then their will be 2 forces acting on the body
1. Applied force (in the direction of motion)
2. friction (opposite to direction of motion)
As applied force is in same direction as displacement so work done will be positive.

10. (a)
the product of component of the force in the direction of the displacement and the magnitude of the displacement

Explanation:
Work done is given by
W = (Fcosθ)d
here Fcosθ is the component of applied force in direction of displacement and d is magnitude of displacement.

11. (d)
241 W

Explanation:
$$P = \frac{W}{t}$$
$$W = mgh = 50 \times 9.8 \times 443$$
$$t = 15 \times 60 \sec$$
$$P = \frac{50 \times 9.8 \times 443}{15 \times 60} = 241W$$

12. (b)
3.77×10^{26} W

Explanation:
Energy liberated per second
$E = mc^2 = 4.19 \times 10^9 \times 3 \times 10^8 \times 3 \times 10^8 = 37.71 \times 10^{25} J$
power output of sun is equal to energy output per second
$P = \frac{W}{t} = \frac{37.71 \times 10^{25}}{1} = 3.77 \times 10^{26} W$

13. (b)
32.0 N

Explanation:
from work–energy theorem
change in kinetic energy = work done

$$\Delta K = W$$
$$K_f - K_i = Fs$$
$$\frac{1}{2}m{v_f}^2 - \frac{1}{2}m{v_i}^2 = Fs$$
$$\frac{1}{2}m\left({v_f}^2 - {v_i}^2\right) = Fs$$

m = 8Kg, s = 2.5m
v_f = 6m/s, v_i = 4m/s

$$\frac{1}{2} \times 8\left(6^2 - 4^2\right) = F \times 2.5$$
$$4 \times 20 = F \times 2.5$$
$$F = \frac{80}{2.5} = 32N$$

14. (c)
forces, doing work on it, are conservative

Explanation:
Mechanical energy is the sum of kinetic and potential energy in an object that is used to do work. In other words, it is energy in an object due to its motion or position, or both. In case of conservative forces total mechanical energy remains conserved because potential energy applicable only for conservative forces.

15. (b)
represents work done by F(x).

Explanation:
Work done by a variable force is given by
W = $\int F(x)dx$
above integration gives us area area under F and x.

16. (d)
35840 J

Explanation:
Kinetic energy of cheetah

$$K = \frac{1}{2}mv^2$$
$$m = 70Kg$$
$$v = 32m/s$$
$$K = \frac{1}{2} \times 70 \times 32 \times 32 = 35840J$$

17. (b)
1 m /s to the left.

Explanation:
from conservation of linear momentum initial momentum = final momentum

$$\vec{p}_i = \vec{p}_f$$
$$(500 \times 0) + [500 \times (-2)] = (500 + 500)\, v$$
$$-1000 = 1000v$$
$$v = -1m/s$$
negative sign indicate that cars moves to the left.

18. (c)
the sum of potential and kinetic energies

Explanation:
mechanical energy = sum of potential and kinetic energies
a falling ball will have both these energies in between topmost and bottomost points of its motion so mechanical energy is the sum of potential and kinetic energies.

19. (d)
43.3 kW

Explanation:
$$P = \frac{W}{t}$$
$$W = mgh$$
$$30m^3 = 30000 = 3 \times 10^4 lit$$
mass of 30000 lit water = 30000 Kg
$P = \frac{mgh}{t} = \frac{3\times10^4\times9.8\times40}{15\times60} = 1.30 \times 10^4 W$
efficiency = power output / power consumption
$$\eta = \frac{P}{P_c}$$
$$P_c = \frac{P}{\eta} = \frac{1.30 \times 10^4}{0.3} = 4.33 \times 10^4 = 43.3KW$$

20. (b)
2.54 m/s

Explanation:
Height of ramp $h = l \sin 30^\circ = 1 \times \frac{1}{2} = 0.5m$
from work kinetic energy theorm
$$K_f - K_i = W_{mg} + W_f$$
$$\frac{1}{2}mv^2 - 0 = mgh + fd$$
$$\frac{1}{2} \times 3v^2 = (3 \times 9.8 \times 0.5) + [5 \times (-1)]$$
$$\frac{3}{2}v^2 = 14.7 - 5$$
$$v = \sqrt{\frac{9.7 \times 2}{3}} = 2.54m/s$$

21. (c)
F.d

Explanation:
Work done = force in the direction of displacement multiplied by displacement
$W = \vec{F}.\vec{d}$

22. (c)

Newton

Explanation:
In International System of Units (SI) the newton is the unit for force. It is equal to the amount of net force required to accelerate a mass of one kilogram at a rate of 1 m/sec^2 in direction of the applied force. It is named after Isaac Newton in recognition of his work on classical mechanics, specifically Newton's second law of motion.
$1N = 1Kgm/\sec^2$
Dyne is a cgs unit of force. One dyne is equal to 10^{-5} N

23. (d)
0, -25.1 J

Explanation:
work done by tension will be zero because tension is perpendicular to displacement.
$W = Ts\cos 90^\circ = 0$
work done by gravity in semicircle from the lowest to the highest point on the path
$W = mgh\cos 180^\circ = 0.8 \times 9.8 \times 3.2 \times (-1) = -25.1J$

24. (c)
a scalar

Explanation:
Scalar product means dot product and dot product of 2 vectors gives a scalar , example dot product of force and displacement gives work which is scalar

25. (d)
The class of forces where work done against the force gets stored up as energy.

Explanation:
Potential energy is the stored energy of an object. It is the energy by virtue of an object's position relative to other objects. Potential energy is often associated with restoring forces such as a spring or the force of gravity. It is applicable only for conservative forces.

26. (a)
50 J

Explanation:
Mass of the body, m= 0.5 kg
Velocity of the body $v = ax^{3/2}$
$\mathrm{a} = 5\mathrm{m}^{-1/2}\mathrm{s}^{-1}$
Initial velocity at x = 0 is u = 0
Final velocity at x = 2 m is $v = 10\sqrt{2}m/s$
work done = Change in kinetic energy

$$W = K_f - K_i$$
$$W = \frac{1}{2}mv^2 - 0$$
$$W = \frac{1}{2} \times 0.5 \times \left(10\sqrt{2}\right)^2 = \frac{1}{2} \times 0.5 \times 200 = 50J$$

27. (a)
25.9 m

Explanation:
Mass of troly M = 200Kg
mass of child m = 20Kg
speed of trolley v = 36Km/hr=36 x 5/18 = 10m/s

Let v' be the final velocity of the trolley with respect to the ground.
Final velocity of the boy with respect to the ground = $v' - 4$
from conservation of linear momentum

$$p_i = p_f$$

$$(M+m)v = Mv' + m(v' - 4)$$

$$(200+20) \times 10 = 200v' + 20(v' - 4)$$

$$2200 = 220v' - 80$$

$$v' = \frac{2280}{220} = 10.36 m/s$$

Time taken by the boy to run t = 10/4 = 2.5 sec
Distance moved by the trolley = $v't = 10.36 \times 2.5 = 25.9m$

28. (c)
depends only on the end points

Explanation:
A force is said to be conservative if work done by this force is independent of path and is dependent only on end points .

29. (c)
5.3 m/s

Explanation:
95% potential energy is converted in kinetic energy.
applying conservation of mechanical energy between horizontal and lowermost points

$$mgl \times \frac{95}{100} = \frac{1}{2}mv^2$$

$$gl \times \frac{95}{100} = \frac{1}{2}v^2$$

$$v = \sqrt{\frac{2 \times gl \times 95}{100}} = \sqrt{\frac{2 \times 9.8 \times 1.5 \times 95}{100}} = 5.3 m/s$$

30. (b)
time dependence

Explanation:
According to work energy theorem :
Net work done on a body equals change in its kinetic energy
So it does not give any information about time dependence.

31. (d)
ball 1 moves to the right with a velocity of 1m/s and ball 2 also moves to the right at 4 m/s

Explanation:

$$m_1 = 100gm$$

$$m_2 = 50gm$$

$$u_1 = 3m/s$$

$$u_2 = 0$$

$$v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)u_1 + \left(\frac{2m_2}{m_1 + m_2}\right)u_2 = \left(\frac{50}{150} \times 3\right) + 0 = 1m/s$$

$$v_2 = \left(\frac{2m_1}{m_1 + m_2}\right)u_1 + \left(\frac{m_2 - m_1}{m_1 - m_2}\right)u_2 = \left(\frac{200}{150} \times 3\right) + 0 = 4m/s$$

32. (c)

8.82 J

Explanation:
Whole of the potential energy of bolt converted in to heat energy
heat produced by the impact = mgh =$0.3 \times 9.8 \times 3 = 8.82J$

33. (c)
4.48 m/s

Explanation:
from work–energy theorem
change in kinetic energy = work done

$$\Delta K = W$$

$$K_f - K_i = Fs$$

$$\frac{1}{2}mv^2 - 0 = Fs$$

m = 4.30Kg, s = 1.2m, F= 36N
v_f = vm/s, v_i = 0

$$\frac{1}{2}mv^2 = Fs$$

$$\frac{1}{2} \times 4.3 \times v^2 = 36 \times 1.2$$

$$v = \sqrt{\frac{36 \times 1.2 \times 2}{4.3}} = 4.48m/s$$

34. (d)
953 N/m

Explanation:
Potential energy of spring converted in to potential energy

$$\frac{1}{2}kx^2 = mgh$$

$$k = \frac{2mgh}{x^2} = \frac{2 \times 35 \times 10^{-3} \times 9.8 \times 20}{0.12 \times 0.12} = 953N/m$$

35. (a)
742.5 W

Explanation:
Total power required to overcome a force of 165 N and to maintain a speed of 9.00 m/s
F = 165N
v = 9m/s

$$P = Fv = 165 \times 9 = 1485W$$

if each rider contribute equal power, then power required per rider will be P/2 = 1485/2 = 742.5W

36. (a)
49000 J

Explanation:
Work done by force applied against gravity for one lift will be

$$W = Fs = mgh = 10 \times 9.8 \times 0.5 = 49J$$

So work done for 1000 lifts = 49 x 1000 = 49000 J

37. (a)
1.10×10^5 J

Explanation:
m = 800Kg per minute
h = 14m
work done per minute in lifting the water
$W = mgh = 800 \times 9.8 \times 14 = 109760J = 1.1 \times 10^5 J$

38. (a)
0.115

Explanation:
Weight of block can be resolved in two components.
component parellal to incline plane $(mg \sin 37^\circ)$and component perpendicular to plane $(mg \cos 37^\circ)$
at equilibrium
R = mg cos 37^o
f = μR = μmg cos 37
Net force acting on the block = $mg \sin 37^\circ - f$
$= mg \sin 37^\circ - \mu mg \cos 37^\circ$
At equilibrium, the work done by the block is equal to the potential energy of the spring, i.e.,
= mg sin 37^o - μmg cos 37^o = $\frac{1}{2}$kx^2
$(1 \times 9.8 \times 0.6) - (\mu \times 1 \times 9.8 \times 0.8) = \frac{1}{2} \times 100 \times 0.1$
0.602 - 0.799μ = 0.510
$\mu = \frac{0.092}{0.799} = 0.115$

39. (d)
-1750 J

Explanation:
$$W = -mgh$$
$$h = x \cos 30^\circ = 2.75 \times \frac{\sqrt{3}}{2}$$
$$W = -75 \times 9.8 \times 2.75 \times \frac{\sqrt{3}}{2} = -1750J$$

40. (a)
0.15 m

Explanation:
for maximum compression
$$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$$
$$x = \sqrt{\frac{mv^2}{k}} = \sqrt{\frac{0.8 \times 1.2 \times 1.2}{50}} = 0.15m$$
the maximum compression of the spring after the collision = 0.15m

Solution

Class 11 - Chemistry

Multiple Choice Examination (October-2019)

Section A

41. (b) 4.2154×10^{23} electrons
Explanation:
$moles\ of\ N_2 = \frac{1.4}{28} = 0.05\ mol$
$And\ 1\ mole\ of\ N_2 = 6.022 \times 10^{23}\ molecules\ of\ N_2$
$And\ 1\ molecule\ of\ N_2\ has\ 14\ electrons$
$total\ number\ of\ electrons\ in\ 1.4\ g\ of\ N_2 = 0.5 \times 6.022 \times 10^{23} \times 14 = 4.214 \times 10^{23}$

42. (c)
$\frac{an^2}{V^2}$

Explanation:
The term represents the correction in pressure due to the forces of attraction between the molecules in a real gas. The actual pressure exerted on the walls of the vessel by real gas is less, by the amount $\frac{an^2}{V^2}$ than the pressure exerted by an ideal gas.

43. (a)
1247.7 g/mol

Explanation:
$PV = \frac{mRT}{M}$
$M = \frac{mRT}{PV}$
$M = \frac{0.0625 g \times 0.083 bar\ dm^3 K^{-1} mol^{-1} \times 819 K}{0.1 bar \times 34.05 \times 10^{-3} dm^3}$
M = 1247.7g/mol

44. (d) High pressure and Low temperature
Explanation:
A gas which obeys the ideal gas equation, p V = nRT under all conditions of temperature and pressure is called an ‘ideal gas’.
However, there is no gas which obeys the ideal gas equation under all conditions of temperature and pressure. Hence, the concept of ideal gas is only theoretical or hypothetical. The gases are found to obey the gas laws fairly well when the pressure is low or the temperature is high.
Such gases are, therefore, known as ‘real gases’. All gases are real gases. Hence, at high pressure and low temperature, a real gas deviates most from ideal behaviour.

45. (c) surface tension
Explanation:
Due to surface Tension, the water droplet tends to acquire minimum surface area, hence water droplet attains spherical shape.

46. (c)
the triple point.

Explanation:
Triple point of a substance is the temperature and pressure at which three phases (i.e. gas, liquid and solid) of that substance coexist at thermal equilibrium.
The triple point of pure water is at 0.01°C (273.16K, 32.01°F) and 4.58 mm (611.2Pa) of mercury, where all the three (i.e., solid, liquid and gas) states coexist in equilibrium.

47. (b)
Decreases

Explanation:
In general, **surface tension** decreases when **temperature** increases because cohesive forces decrease with an **increase** of molecular thermal activity. The influence of the surrounding environment is due to the adhesive action **liquid** molecules have at the interface.

48. (b) Decreases
Explanation:
As temperature increases surface tension decreases beacuse the cohesive forces decreases with increase of molecular thermal activity.

49. (b)
hydrogen bonds.

Explanation:
In water molecules, due to high electronegitivity difference between H and O atoms and lone pairs of electrons on oxygen atom, greater number of hydrogen bonds formed

50. (b)
It has comparatively more force of attraction than other gases

Explanation:
It has comparatively more force of attraction than other gases

51. (d)
Directly proportional to its absolute temperature

Explanation:
The question is based on understanding the postulates of kinetic theory of gases, according to which,the average kinetic energy of a gas particle is **directly proportional** to the **absolute** temperature. An increase in temperature increases the speed in which the gas molecules move. All gases at a given temperature have the same average kinetic energy.

52. (b) less than unit electronic charge
Explanation:
Partial charge is a small charge developed by displacement of electrons. It is less than unit electronic charge and is represented as δ^+ or δ^-

53. (b)
70 g/mol

Explanation:
using relation; PV=(m/M)RT
we have
$P_1M_1 = P_2M_2$
$P_1 = \frac{P_2M_2}{M_1} = \frac{5\times28}{2} = 70$

54. (a)
In hydrogen bonding H atom becomes partially negative and is attracted to the more positive N atom.

Explanation:
Hydrogen atom covalently bonded to highly electronegative atom such as N,O experience electrostatic field of another highly electronegative atom due to which a partial positive charge is developed on H atom.

55. (c)
Increases by three times

Explanation:
This question is based on simple application of Boyle's Law which states that the pressure of a given mass of an ideal gas is inversely proportional to its volume at a constant temperature.
$P_1V_1 = P_2V_2$
$according\ to\ the\ question,\ P_1 = P,\ V_1 = V\ ,\ P_2 = \frac{P}{3},\ V_2 = ?$
$V_2 = \frac{P_1V_1}{P_2} = \frac{P\ V}{\frac{P}{3}} = 3V$

56. (c)
$V\alpha T$

Explanation:
Charles' Law states that the volume of a fixed mass of a gas is directly proportional to the absolute temperature,**when pressure is kept constant**.

57. (a)
8.314×10^4 Pa

Explanation:
Acc. To Daltons Law
$P = P_1 + P_2$
and by applying PV=nRT
$P_1 \times 9 = 0.2 \times RT$ and $P_2 \times 9 = 0.1 \times RT$ where T = 300K
now using $P = P_1 + P_2$
$P = P_1 + P_2 = \frac{(0.2+0.1)}{9} \times RT = \frac{(0.2+0.1)}{9} \times \frac{0.0821\times300}{1} = 0.82\ atm$
$P = 0.82\ atm = 0.82 \times 101325 = 83086.5\ pa = 8.3 \times 10^4\ pa$

58. (b)
Varies directly with the temperature

Explanation:
The question is based on statement of **Gay Lussac's law**-" At constant temperature, the pressure of a given mass of a gas is directly proportional to its absolute temperature."
mathematically;
$P\alpha T$ (at constant temperature)
or P/T = constant

59. (a)
Equal to one

Explanation:
Compressibility Factor :
It is simply defined as the ratio of the molar volume of a **gas** to the molar volume of an **ideal gas** at the same temperature and pressure. hence for an ideal gas, the compressibility factor is equal to 1. The Compressibility Factor is a useful thermodynamic property for modifying the **ideal gas** law to account for the real **gas** behavior.

60. (d) 0.8 bar
Explanation:
A mixture of H_2 and O_2 contains 20% by weight of H_2 means H_2= 20g and O_2 =80g
moles of hydrogen , $n_{H_2} = \frac{20}{2} = 10\ mol$
moles of oxygen, $n_{O_2} = \frac{80}{32} = 2.5\ mol$
mole fraction of hydrogen, $x_{H_2} = \frac{n_{H_2}}{n_{H_2}+n_{O_2}} = \frac{10}{10+2.5} = 0.8$
partial pressure of H_2 , $P_{H_2} = P_{Total} \times x_{H_2} = 1bar \times 0.8 = 0.8\ bar$

61. (b)
ΔS (system) decreases but ΔS (surroundings) increases.

Explanation:
For freezing of process since process is spontaneous therefore if ΔS (system) decreases but ΔS (surroundings) increases.Also, Freezing is exothermic process. The heat released increases the entropy of surrounding.

62. (c) volume
Explanation:
An isochoric process is a thermodynamic process in which the volume remains constant.

63. (d)
ΔH > 0 hence process is endothermic

Explanation:

Heat is utilized in this reaction so reaction is endothermic and for an endothermic process $\Delta H > 0$.

64. (c)
ΔG is positive for a spontaneous reaction

Explanation:
$\Delta G < 0$ (negative) for a spontaneous change.

65. (c)
$JK^{-1}\ mol^{-1}$

Explanation:
$As\ \triangle S = \frac{q_{rev}}{T}$
$It\ is\ an\ extensive\ entropy,\ therefore,\ the\ SI\ \ unit\ of\ entropy\ change\ is\ Joule\ K^{-1}mol^{-1}$

66. (b)
$2C_4H_{10}\,(g) + 13O_2\,(g) \rightarrow 8CO_2\,(g) + 10H_2O\,(l)\,\Delta_c H = -2658.0\ kJ\ mol^{-1}$

Explanation:
Enthapy of combustion is the energy released when 1mole of a hydrocarbon (butane) reacts completely in presence of excess of oxygen. The chemical equation for exothermic reaction for combustion of one mole of butane is represented as;
$2C_4H_{10}\,(g) + 13O_2\,(g) \rightarrow 8CO_2\,(g) + 10H_2O\,(l)\,\Delta_c H = -2658.0\ kJ\ mol^{-1}$

67. (b)
2000 K

Explanation:
Gibbs free energy, $\Delta G = \Delta H - T\Delta S$.
At equilibrium $\Delta G = 0$; then $T = \Delta H/\Delta S$ = 2000K.
Therefore, above 2000K, the reaction will be spontaneuous.

68. (b)
the rate at which a reaction proceeds.

Explanation:
Thermodynamics tells that whether reaction will take place or not. It doesnot tell about the rate (speed) of reaction.

69. (c)
spontaneous at all temperature

Explanation:
We know, $\Delta G = \Delta H - T\Delta S$
ΔH = -ve (as reaction is exothermic)
ΔS = +ve
so, $\Delta G = -\Delta H - T\Delta S$
ΔG will be negative at all temperature hence reaction will be spontaneous at all temperature.

70. (b)
$C_p > C_v$

Explanation:
We know, $C_p - C_v = R$
Hence, $C_p > C_v$

71. (c)
-778 kJ

Explanation:
$Heat\ of\ reaction,\ \triangle_r H = \sum \triangle_r H_{products} - \sum \triangle_r H_{reactants}\ \ \Rightarrow \triangle_r H = [\triangle_f H(N_2O) + 3\triangle_f H(CO_2)] - [\triangle_f H(N_2O_4) + 3\triangle_f H(CO)] \Rightarrow \triangle_r H = [81\ + \{3 \times (-39$

72. (b)
enthalpy of fusion + enthalpy of vapourisation

Explanation:
The process of sublimation involves the change of solid into vapour. Though in sublimation a solid does not pass through the liquid phase on its way to the gas phase, the enthalpy change is equal to the sum of enthalpy of fusion and enthalpy of vaporization because enthalpy is a state function.

73. (a)
q = 0

Explanation:
Adiabatic condition would not allow exchange of heat between system and surroundings. Hence q = 0

74. (b)
may be positive or negative

Explanation:
Standard molar enthapy of formation of a compound from its elements can be +ve or –ve.
$For\ example:\ C\ +\ O_2(g) \rightarrow\ CO_2(g)\ ;\ \triangle_r H =\ -393.5\ kJmol^{-1}$
$N_2(g)\ +\ \frac{1}{2}\ O_2\ (g)\ \rightarrow N_2O\ (g\ )\ ; \triangle_r H =\ +92\ kJmol^{-1}$

75. (a)
Work

Explanation:
Work is not a state function because it is proportional to the distance an object is moved, which depends on the path used to go from the initial to the final state.

76. (a)
one mole of a compound from its elements in their most stable states of aggregation.

Explanation:
The standard enthalpy change for the formation of one mole of a compound from its elements in their most stable states of aggregation (reference states) is standard molar enthalpy of formation.

77. (b)
all of these

Explanation:
The bond enthalpy depends on many factors: sizes of atoms involved in the bond, differences in their electronegativity, bond length, electron affinities etc.

78. (d)
pressure, volume, temperature, amount

Explanation:
State of gas constant is determined by stating the value of P,V,n,T.
i.e. $R = \frac{PV}{nT}$

79. (d)
-315 kJ

Explanation:
When 1 mole of CO_2 is produced energy released is –393.5 kJ mol^{-1}. Moles of CO_2 given = 35.2/44 = 0.8 moles; So energy released $= 0.8 \times 393.5$ kJ/mol = 315 kJ/mol

80. (d)
Enthalpy of fusion

Explanation:
In this process 1 mole of solid water is converted to liquid state. Fusion or melting is endothermic, so all enthalpies of fusion are positive.

Solution

Class 11 - Mathematics

Multiple Choice Examination (October-2019)

Section A

81. (a)
3168

Explanation:
First we will find the number of four digit numbers (i.e, numbers from 1000 to 9999) which can be formed using the digits 0,1,2,3,4,5,6,7,8 and 9 with repitition allowed.
Now we have the first place can be filled by any of the 9 digits other than 0 and since repetition is allowed second ,third and fourth can be filled by any of the ten digits.
Hence total number of four digit numbers =$9 \times 10 \times 10 \times 10 = 9000$
Now we will consider the case that the number does not have the digit '7'
Now the first place can be filled by any of the 8 digits other than 0 and 7 since repetition is allowed second ,third and fourth can be filled by any of the 9 digits other than 7.
Hence total number of ways we can form a four digit number with out 7 =$8 \times 9 \times 9 \times 9 = 5832$
Hence total number of ways in which we can form a four digit number having atleast one digit as 7=$9000 - 5832 = 3168$

82. (c) 18
Explanation:
We have 1600=$2^6.5^2$
To form factors we have to do selections from a lot of 2's and 5's and multiply them together.
To form even factor we should choose at least one 2's from the lot , which will ensure that what ever be the remaining selection, their multiplication will always result in an even factor.
The number of ways to select atleast one '2' from a lot of six identical '2's will be 6 (i.e. select 1 or select 2 or select 3 or select 4 or select 5 or select 6)
And, we'll select any number of '5 from a lot of two identical '5's in 3 ways(select 0, select 1,select 2)
There fore the total number of selection of even factors=6x3=18

83. (b) 20
Explanation:
We have octagon is an eight sided polygon which has 8 vertices.
A diagonal is obtained by joining two points .
Thus the number of diagonals obtained by joining any two points out of 8 is given by
$8C_2 \quad - 8 = \frac{8!}{2!(8-2)!} - 8 = \frac{1\times2\times3\times4\times5\times6\times7\times8}{1\times2\times1\times2\times3\times4\times5\times6} - 8 = \frac{7\times8}{1\times2} - 8 = 28 - 8 = 20$

84. (b) 104
Explanation:
Every two straight lines can make one point of intersection.
Number of points of intersection=$^8C_2 \quad .1 = 28$

Every two circles can make two points of intersection.
Number of points of intersection ==$^4\ C_2 \quad .2 = 12$

Each circle can make two intersection points with each straight line
Number of points of intersection ==$^4\ C_1 \quad .^8C_1 \quad .2 = 64$

Therefore, required number of points of intersection
=28+12+64=104

85. (d)
$2\ \times 4!\ \times\ 4!$

Explanation:
there are 4 boys and 4 girls and the row can start either with a boy or girl, therefore the number of ways are 4! x 4! x 2

86. (b) 4464
Explanation:
First we will find the number of four digit numbers that can be formed using the digits 0,1,2,3,4,5,6,7,8,9 with repetition .
The first place can be filled by any of the 9 digits other than 0, and the second, third and the fourth places each can be filled by any of the ten digits
Hence the total number of ways of forming a four digit number = $9 \times 10 \times 10 \times 10 = 9000$
Now we will find the number of four digit numbers in which nall the digits are distinct
The first place can be filled by any of the 9 digits other than 0, and the second, can be filled by any of the remaining 9 digits since repetition is not possible
Similarly third and the fourth places each can be filled by 8 and 7 digits respectively
Hence the total number of ways of forming a four digit number with distinct digits b= $9 \times 9 \times 8 \times 7 = 4536$
The total number of numbers from 1000 to 9999 (both inclusive) that do not have 4 different digits=$9000 - 4536 = 4464$

87. (c) 3600
Explanation:
First we will fix one person from the 6 boys then 5 others can be arranged in 5! ways=120 ways

Now there are 6 places left in which 2 brothers can sit,so they can choose any 2 places from the 6 places in 6C2 ways=15 ways

Also 2 brothers can arrange themselves in 2! ways
So th ways in which the two brothers can be seated=15*2=30

Hence total ways in which all can be seated =120*30=3600

88. (c)
r = 0 or 1

Explanation:
Given P(n,r) = C(n,r)

$\Rightarrow \frac{n!}{(n-r)!} = \frac{n!}{r!(n-r)!}$
$\Rightarrow 1 = \frac{1}{r!}$
$\Rightarrow r! = 1$
$\Rightarrow r = 0 \quad or \quad r = 1 [\because \quad 0! = 1 \quad , \quad 1! = 1]$

89. (b) $5! \times 4!$
Explanation:
If there are n objects to be arranged in circular order the no of permutations possible=$(n-1)!$
First we will make the 5 girls around the table and this can be done in $(5-1)! = 4! = 24$, different ways
Now we have 5 places available between these girls and the 5 boys can be seated in these 5 available places in $5! = 120$, different ways
Hence the 5 boys and 5 girls can be arranged in $4!.5! = 24.120 = 2880$ways

90. (d) $3^{12} - 1$
Explanation:
Since a student can solve each question in 3 different ways - either he can attempt the first alternative ,or the second alternative or he can leave it unanswered.
Hence number of ways in which a student can attempt one or more of the 12 given questions =3^{12}
Now we can consider a case that the student leave all the 12 given questions unanswered.
The number of ways, in which a student can select one or more questions out of 12 each having an alternative= $3^{12} - 1$

91. (b) 720
Explanation:
We have to find the total number of four digit odd numbers formed using the digits 0,1,2,3,5,7
Since it is an odd number the last place (unit's place) can be filled by any of the odd numbers 1,3,5,7 in 4 different ways.
Since repetition is allowed the second and third places can be filled by any of the six given digits
Since it has to be a four digit number the first place can be filled by any of the five given digits other than zero in 5 ways
Hence all the four places can be filled in $4 \times 6 \times 6 \times 5 = 720$ ways

92. (b) 69760
Explanation:
As we have the ten digits from 0 to 9 which can be used
Number of five digit telephone numbers in which the digits can be repeated=$10^5 = 100000$
Number of five digit telephone numbers in which the digits cannot be repeated=${}^{10}P_5 = \frac{10!}{(10-5)!} = 6 \times 7 \times 8 \times 9 \times 10 = 30240$
Therefore the number of five digit telephone numbers in which atleast one digit is repeated=$100000 - 30240 = 69760$

93. (d)
40320

Explanation:
The word " LAUGHTER" has consist of 8 letters which are all distinct
Hence the required number of arrangements=${}^8P_8 = 8! = 40320$

94. (d)
5

Explanation:
$Given \quad {}^{10}P_r = 2.{}^9P_r$
$\Rightarrow \frac{10!}{(10-r)!} = 2.\frac{(9)!}{(9-r)!}$
$\Rightarrow \frac{10 \times 9!}{(10-r) \times (9-r)!} = 2.\frac{(9)!}{(9-r)!}$
$\Rightarrow \frac{10}{(10-r)} = 2$
$\Rightarrow 10 = 20 - 2r$
$\Rightarrow 2r = 10$
$\Rightarrow r = 5$

95. (c) 27
Explanation:
Given xyz=30
We have the possible values of x ,y,z are the following triads
1,1,30
1,2,15
1,3,10
1,5,6
2,3,5
First one can have 3!/2! = 3 ways and the remaining four triads can have 3! combinations
Hence total combinations = 3 + 4*3! = 27

96. (a)
$x < y$

Explanation:

$Given \quad x = 99^{50} + 100^{50} \quad and \quad y = (101)^{50}$

$Now \quad y = (101)^{50} = (100+1)^{50} = ^{50}C_0 \quad (100)^{50} + ^{50}C_1 \quad (100)^{49} + ^{50}C_2 \quad (100)^{48} + \ldots\ldots\ldots\ldots + ^{50}C_{50} \quad \ldots\ldots\ldots\ldots(i)$

$Also \quad (99)^{50} = (100-1)^{50} = ^{50}C_0 \quad (100)^{50} - ^{50}C_1 \quad (100)^{49} + ^{50}C_2 \quad (100)^{48} - \ldots\ldots\ldots\ldots + ^{50}C_{50} \quad \ldots\ldots\ldots(ii)$

$Now \quad subtract \quad equation \quad (ii) \quad from \quad equation \quad (i), \quad we \quad get$

$(101)^{50} - (99)^{50} = 2\left[^{50}C_1 \quad (100)^{49} + ^{50}C_3 \quad (100)^{47} + \ldots\ldots\ldots\right]$

$= 2\left[50(100)^{49} + \frac{50\times49\times48}{3\times2\times1}(100)^{47} + \ldots\ldots\ldots\right]$

$= (100)^{50} + 2\left(\frac{50\times49\times48}{3\times2\times1}(100)^{47}\right)$

$\Rightarrow (101)^{50} - (99)^{50} > (100)^{50}$

$\Rightarrow (101)^{50} > (100)^{50} + (99)^{50}$

$\Rightarrow y > x$

97. (d)

$61236x^5y^5$

Explanation:

$We \quad have \quad the \quad general \quad term \quad of \quad (x+a)^n \quad is \quad T_{r+1} = ^nC_r \quad (x)^{n-r}a^r$

$Now \quad consider\left(\frac{x}{3} + 9y\right)^{10}$

$Here \quad T_{r+1} = ^{10}C_r \quad \left(\frac{x}{3}\right)^{10-r}(9y)^r$

$Since \quad n = 10 \quad is \quad even \quad , \quad the \quad middle \quad term \quad is \quad \left(\frac{n}{2}+1\right) = \left(\frac{10}{2}+1\right) = 6 \quad th \quad term$

$Now \quad T_6 = T_{5+1} = ^{10}C_5 \quad \left(\frac{x}{3}\right)^{10-5}(9y)^5 = ^{10}C_5 \quad \left(\frac{x}{3}\right)^5(9y)^5 = ^{10}C_5 \quad \times 3^5x^5y^5 = 61236x^5y^5$

98. (c)

$\frac{35}{48}$

Explanation:

$We \quad have \quad the \quad general \quad term \quad of \quad (x+a)^n \quad is \quad T_{r+1} = ^nC_r \quad (x)^{n-r}a^r$

$Now \quad consider \quad \left(3 - \frac{x^3}{6}\right)^7$

$Here \quad T_{r+1} = ^7C_r \quad (3)^{7-r}\left(-\frac{x^3}{6}\right)^r$

$Comparing \quad the \quad indices \quad of \quad x \quad in \quad x^{12} \quad and \quad in \quad T_{r+1}, \quad we \quad get$

$3r = 12 \Rightarrow r = 4$

$Therefore \quad the \quad required \quad term \quad is \quad T_{4+1} = \quad T_4 = ^7C_4 \quad (3)^{7-4}\left(-\frac{x^3}{6}\right)^4 = 35 \times 3^3 \times \quad \frac{x^{12}}{6^4} = \frac{35}{48}x^{12}$

99. (a)

3

Explanation:

$(1+x+x^2)^3 = \left[1+(x+x^2)\right]^3 = ^3C_0 \quad + ^3C_1 \quad (x+x^2) + ^3C_2 \quad (x+x^2)^2 + ^3C_3 \quad (x+x^2)^3$

$= 1 + 3(x+x^2) + 3(x^2+2x^3+x^4) + (x^3+3x^4+3x^5+x^6)$

$Hence \quad coefficient \quad of \quad x^5 = 3$

100. (c)

a rational number

Explanation:

$We \quad have \quad (a+b)^n + (a-b)^n$

$= \left[^nC_0 \quad a^n + ^nC_1 \quad a^{n-1}b + ^nC_2 \quad a^{n-2}b^2 + ^nC_3 \quad a^{n-3}b^3 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots + ^nC_n \quad b^n\right] + \left[^nC_0 \quad a^n - ^nC_1 \quad a^{n-1}b + ^nC_2 \quad a^{n-2}b^2 - ^nC_3 \quad a^{n-3}b^3 + \ldots\right.$

$= 2\left[^nC_0 \quad a^n + ^nC_2 \quad a^{n-2}b^2 + \ldots\ldots\ldots\ldots\right]$

$Let \quad a = \sqrt{5} \quad and \quad b = 1 \quad and \quad n = 4$

$Now \quad we \quad get \quad \left(\sqrt{5}+1\right)^4 + \left(\sqrt{5}-1\right)^4 = 2\left[^4C_0 \quad \left(\sqrt{5}\right)^4 + ^4C_2 \quad \left(\sqrt{5}\right)^2 1^2 + ^4C_4 \quad \left(\sqrt{5}\right)^0 1^4\right]$

$= 2\left[25 + 30 + 1\right] = 112$

101. (d)

5^n

Explanation:

$\sum_{r=0}^{n} 4^r.^nC_r \quad = 4^0.^nC_0 \quad + 4^1.^nC_1 \quad + 4^2.^nC_2 \quad + \ldots\ldots + 4^n.^nC_n$

$= 1 + 4.^nC_1 \quad + 4^2.^nC_2 \quad + \ldots\ldots + 4^n.^nC_n$

$= (1+4)^n = 5^n$

102. (c)

-19

Explanation:

$\left(1-3x+7x^2\right)(1-x)^{16} = \left(1-3x+7x^2\right)\left(^{16}C_0 \quad - ^{16}C_1 \quad (x) + ^{16}C_2 \quad (x)^2 - ^{16}C_3 \quad (x)^3 + ^{16}C_4 \quad (x)^4 - ^{16}C_5 \quad (x)^5 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\right.$

$= \left(1-3x+7x^2\right)\left(1-16x+120(x)^2 - \ldots\ldots\ldots\right)$

$Therefore \quad the \quad coefficient \quad of \quad x \quad in \quad the \quad product \quad \left(1-3x+7x^2\right)(1-x)^{16} = 1 \times -16 + 1 \times -3 = -19$

103. (b)

an even positive integer

Explanation:
$We \quad have \quad (a+b)^n+(a-b)^n$
$=\left[{ }^n C_0 \quad a^n+{ }^n C_1 \quad a^{n-1} b+{ }^n C_2 \quad a^{n-2} b^2+{ }^n C_3 \quad a^{n-3} b^3+\ldots\ldots\ldots\ldots\ldots\ldots+{ }^n C_n \quad b^n\right]+\left[{ }^n C_0 \quad a^n-{ }^n C_1 \quad a^{n-1} b+{ }^n C_2 \quad a^{n-2} b^2-{ }^n C_3 \quad a^{n-3} b^3+\ldots\right.$
$=2\left[{ }^n C_0 \quad a^n+{ }^n C_2 \quad a^{n-2} b^2+\ldots\ldots\ldots\ldots\right]$
$Let \quad a=\sqrt{3} \quad and \quad b=1 \quad and \quad n=2n$
$(\sqrt{3}+1)^{2n}+(\sqrt{3}-1)^{2n}=2\left[{ }^{2n} C_0 \quad (\sqrt{3})^{2n}+{ }^{2n} C_2 \quad (\sqrt{3})^{2n-2} 1^2+{ }^{2n} C_4 \quad (\sqrt{3})^{2n-4} 1^4+\ldots\ldots\ldots\ldots\right]$
$=2\left[{ }^{2n} C_0 \quad (3)^n+{ }^{2n} C_2 \quad (3)^{n-1}+{ }^{2n} C_4 \quad (3)^{n-2}+\ldots\ldots\ldots\ldots\right]$
$=2(a \quad positive \quad integer)$
$Hence \quad we \quad have \quad (\sqrt{3}+1)^{2n}+(\sqrt{3}-1)^{2n} \quad is \quad always \quad an \quad even \quad positive \quad integer$

104. (d)
-20

Explanation:
$Since \quad n=6 \quad is \quad even \quad ,its \quad middle \quad term \quad is \quad the \quad 4th \quad term.$
$We \quad have \quad the \quad general \quad term \quad of \quad (x+a)^n \quad is \quad T_{r+1}={ }^n C_r \quad (x)^{n-r} a^r$
$Now \quad consider \left(\frac{2a}{3}-\frac{3}{2a}\right)^6$
$Here \quad T_{r+1}={ }^6 C_r \quad \left(\frac{2a}{3}\right)^{6-r}\left(-\frac{3}{2a}\right)^r$
$Required \quad term \quad is \quad T_4= \quad T_{3+1}= \quad { }^6 C_3 \quad \left(\frac{2a}{3}\right)^{6-3}\left(-\frac{3}{2a}\right)^3=-20 \times(2a)^0 \times(3)^0=-20$

105. (d)
$\frac{9}{7}$

Explanation:
$(3+ax)^9= \quad { }^9 C_0 \quad 3^9+{ }^9 C_1 \quad 3^8(ax)+{ }^9 C_2 \quad 3^7(ax)^2+{ }^9 C_3 \quad 3^6(ax)^3+\ldots\ldots\ldots\ldots$
$Given \quad that \quad coefficients \quad of \quad x^2=coefficients \quad of \quad x^3$
$\Rightarrow{ }^9 C_2 \quad 3^7 a^2={ }^9 C_3 \quad 3^6 a^3$
$\Rightarrow \frac{9!}{2!.7!}.3=\frac{9!}{6!.3!}.a$
$\Rightarrow \frac{3}{7}=\frac{a}{3}$
$\Rightarrow a=\frac{9}{7}$

106. (b)
0

Explanation:
$Let \quad the \quad common \quad difference \quad of \quad the \quad A.P \quad be \quad d$
$Then \quad we \quad have \quad if$
$a=x$
$b=x+d$
$c=x+2d$
$d=x+3d \quad and$
$e=x+4d$
$\therefore a–4b+6c–4d+e=x-4(x+d)+6(x+2d)-4(x+3d)+(x+4d)$
$=(x-4x+6x-4x+x)+(-4d+12d-12d+4d)=0$

107. (b)
2 : 1

Explanation:
$Let \quad the \quad two \quad positive \quad numbers \quad be \quad x \quad and \quad y$
$Now \quad given \quad \frac{x}{y}=\frac{2+\sqrt{3}}{2-\sqrt{3}}$
$So \quad let \quad x=(2+\sqrt{3}) k \quad and \quad y=(2-\sqrt{3}) k$
$\therefore \frac{A.M \quad of \quad x \quad and \quad y}{G.M \quad of \quad x \quad and \quad y}=\frac{\frac{x+y}{2}}{\sqrt{xy}}=\frac{x+y}{2\sqrt{xy}}=\frac{(2+\sqrt{3})k+(2-\sqrt{3})k}{2\sqrt{(2+\sqrt{3})k.(2-\sqrt{3})k}}$
$=\frac{4k}{2\sqrt{(4-3)k^2}}=\frac{4k}{2k}=\frac{2}{1} \qquad [\because(a+b)(a-b)=a^2-b^2]$

108. (a)
$\frac{b}{b-a}$

Explanation:
$Given \quad a_1=a, a_2=b \quad and \quad a_n=2a$
$Hece \quad d=b-a$
$Now \quad a_n=a+(n-1)d \Rightarrow 2a=a+(n-1)(b-a)$
$\Rightarrow a=(n-1)(b-a)$
$\Rightarrow \frac{a}{b-a}+1=n$
$\Rightarrow n=\frac{b}{b-a}$

109. (d)
G.P.

Explanation:
$Let \quad \frac{a+bx}{a-bx} = \frac{b+cx}{b-cx} = \frac{c+dx}{c-dx} = k(say)$
$Now \quad consider \quad \frac{a+bx}{a-bx} = k$
$Applying \quad componendo \quad dividendo, \quad we \quad get$
$\frac{a+bx+a-bx}{a+bx-a+bx} = \frac{k-1}{k+1}$
$\Rightarrow \frac{a}{bx} = \frac{k-1}{k+1} \ldots\ldots\ldots\ldots(i)$
$Now \quad applying \quad componendo \quad dividendo, \quad on \quad \frac{b+cx}{b-cx} = k \quad we \quad get$
$\frac{b+cx+b-cx}{b+cx-b+cx} = \frac{k-1}{k+1}$
$\Rightarrow \frac{b}{cx} = \frac{k-1}{k+1} \ldots\ldots\ldots\ldots(ii)$
$Again \quad applying \quad componendo \quad dividendo, \quad on \quad \frac{c+dx}{c-dx} = k \quad we \quad get$
$\frac{c+dx+c-dx}{c+dx-c+dx} = \frac{k-1}{k+1}$
$\Rightarrow \frac{c}{dx} = \frac{k-1}{k+1} \ldots\ldots\ldots\ldots(iii)$
$From \quad equations \quad (i),(ii) and \quad (iii) \quad we \quad get \quad \frac{a}{bx} = \frac{b}{cx} = \frac{c}{dx}$
$\Rightarrow \frac{a}{b} = \frac{b}{c} = \frac{c}{d}$
$\Rightarrow a,b,c \quad and \quad d \quad are \quad in \quad G.P$

110. (c)
$\frac{3}{5}$

Explanation:
$Given \quad \frac{T_1+T_2+T_3}{T_4+T_5+T_6} = \frac{125}{27}$
$\Rightarrow \frac{T_1+T_2+T_3}{T_1+T_2+T_3+T_4+T_5+T_6} = \frac{125}{152} \qquad \left[If \frac{a}{b} = \frac{c}{d} \quad then \frac{a}{a+b} = \frac{c}{c+d}\right]$
$\Rightarrow \frac{S_3}{S_6} = \frac{125}{152}$
$We \quad have \quad for \quad a \quad G.P \quad , \quad S_n = \frac{a(r^n-1)}{r-1}, r > 1$
$\therefore \frac{\frac{a\left(r^3-1\right)}{r-1}}{\frac{a\left(r^6-1\right)}{r-1}} = \frac{125}{152}, r-1 \neq 0$
$\Rightarrow \frac{r^3-1}{r^6-1} = \frac{125}{152}$
$\Rightarrow 125r^6 - 152r^3 - 27 = 0$
$\Rightarrow 125r^6 - 125r^3 - 27r^3 - 27 = 0$
$\Rightarrow 125r^3\left(r^3-1\right) - 27\left(r^3-1\right) = 0$
$\Rightarrow \left(r^3-1\right)\left(125r^3-27\right) = 0$
$\Rightarrow r^3 = 1 \quad or \quad \frac{27}{125}$
$\Rightarrow r = 1, \frac{3}{5}$
$since \quad r-1 \neq 0, \quad r \quad cannot \quad be 1$
$\Rightarrow r = \frac{3}{5}$

111. (a)
7

Explanation:
$We \quad have \quad 1,3,3^2,3^3,\ldots\ldots\ldots\ldots,3^{n-1} \quad is \quad a \quad G.P with \quad first \quad term \quad 1 \quad and \quad common \quad ratio \quad r=3$
$Now \quad 1+3+3^2+3^3+\ldots\ldots\ldots\ldots+3^{n-1} = S_n = \frac{a(r^n-1)}{r-1} = \frac{1(3^n-1)}{3-1}$
$Hence \quad 1+3+3^2+3^3+\ldots\ldots\ldots\ldots+3^{n-1} > 1000 \Rightarrow \frac{3^n-1}{2} > 1000$
$\Rightarrow 3^n > 2001$
$But \quad we \quad have \quad 3^6 = 729 \quad and \quad 3^7 = 2187$
$Therefore \quad least \quad value \quad of \quad n = 7$

112. (b)
128

Explanation:
$Let \quad a \quad be \quad the \quad first \quad term \quad and \quad r \quad be \quad the \quad common \quad ratio \quad of \quad the \quad G.P$
$Given \quad T_4 = 2 \Rightarrow ar^3 = 2$
$Then \quad product \quad of \quad the \quad first \quad 7 \quad terms = a.ar.ar^2.ar^3.ar^4.ar^5.ar^6 = a^7r^{21} = \left(ar^3\right)^7 = 2^7 = 128$

113. (d)
$\frac{3}{5}$

Explanation:

$Given \quad \frac{S_3}{S_6} = \frac{125}{152}$

$\Rightarrow \frac{\frac{a(r^3-1)}{r-1}}{\frac{a(r^6-1)}{r-1}} = \frac{125}{152}, r-1 \neq 0$

$\Rightarrow \frac{r^3-1}{r^6-1} = \frac{125}{152}$

$\Rightarrow 152r^3 - 152 = 125r^6 - 125$

$\Rightarrow 125r^6 - 152r^3 + 27 = 0$

$\Rightarrow 125r^6 - 125r^3 - 27r^3 + 27 = 0$

$\Rightarrow 125r^3 (r^3 - 1) - 27 (r^3 - 1) = 0$

$\Rightarrow (125r^3 - 27)(r^3 - 1) = 0$

$\Rightarrow r^3 = \frac{27}{125} \quad or \quad r^3 = 1$

$since \quad r - 1 \neq 0 \quad , \quad r \quad cannot \quad be \quad 1$

$\Rightarrow r = \frac{3}{5}$

114. (a)
1

Explanation:

$We \quad have \quad A.M \quad of \quad a \quad and \quad b \quad is \frac{a+b}{2}$

$Given \quad \frac{a^n+b^n}{a^{n-1}+b^{n-1}} = \frac{a+b}{2}$

$\Rightarrow 2(a^n + b^n) = (a+b).(a^{n-1} + b^{n-1})$

$\Rightarrow 2a^n + 2b^n = a^n + ab^{n-1} + ba^{n-1} + b^n$

$\Rightarrow a^n + b^n = ab^{n-1} + ba^{n-1}$

$\Rightarrow a^n - ba^{n-1} = ab^{n-1} - b^n$

$\Rightarrow a^{n-1}(a-b) = b^{n-1}(a-b)$

$\Rightarrow \frac{a^{n-1}}{b^{n-1}} = 1 = \left(\frac{a}{b}\right)^0$

$\Rightarrow n - 1 = 0$

$\Rightarrow n = 1$

115. (d)
11

Explanation:

$Given \quad a = 11 and \quad S_4 = 56$

$Let \quad d \quad be \quad the \quad common \quad difference \quad of \quad the \quad A.P$

$We \quad have \quad S_n = \frac{n}{2}[2a + (n-1)d]$

$\Rightarrow 56 = \frac{4}{2}[22 + 3d]$

$\Rightarrow 56 - 44 = 6d$

$\Rightarrow d = \frac{12}{6} = 2$

$Last \quad four \quad terms \quad of \quad the \quad A.P \quad can \quad be \quad taken \quad as \quad a_n, a_{n-1}, a_{n-2}, a_{n-3}$

$Now \quad a_n = a + (n-1)d$

$\Rightarrow a_n = 11 + (n-1)2 \quad , a_{n-1} = 11 + (n-2)2, a_{n-2} = 11 + (n-3)2, a_{n-3} = 11 + (n-4)2$

$Hence \quad sum \quad of \quad the \quad last \quad four \quad terms = a_n + a_{n-1} + a_{n-2} + a_{n-3} = 112$

$\Rightarrow 11 + (n-1)2 + 11 + (n-2)2 + 11 + (n-3)2 + 11 + (n-4)2$

$\Rightarrow 44 + 2[n - 1 + n - 2 + n - 3 + n - 4] = 112$

$\Rightarrow 2[4n - 10] = 68$

$\Rightarrow n = \frac{88}{8} = 11$

116. (c)
G.P.

Explanation:

$If \quad the \quad numbers \quad a,b,c \quad are \quad in \quad A.P., \quad we \quad have \quad b = \frac{a+c}{2}.....(i)$

$Since \quad b,c,d \quad are \quad in \quad G.P. \quad we \quad get \quad c^2 = bd......(ii)$

$Now \quad c,d,e \quad are \quad in \quad H.P \quad implies \quad d = \frac{2ce}{c+e}......(iii)$

$Substituting \quad (i) \quad and \quad (iii) \quad in \quad equation \quad (ii) \quad , \quad we \quad get \quad c^2 = \frac{a+c}{2}.\frac{2ce}{c+e}$

$\Rightarrow c = \frac{ae+ce}{c+e}$

$\Rightarrow c^2 + ce = ae + ce$

$\Rightarrow c^2 = ae$

$\Rightarrow a,c,e \quad are \quad in \quad G.P$

117. (d)
mn

Explanation:

$Let \quad a \quad be \quad the \quad first \quad term, \quad d \quad be \quad the \quad common \quad difference \quad and \quad n \quad be \quad the \quad number \quad of \quad terms \quad of \quad the \quad A.P$

$Then \quad we \quad have \quad S_n = \frac{n}{2}[2a + (n-1)d] = n\left[a + \frac{n-1}{2}d\right] \ldots\ldots\ldots(i)$

$As \quad n \quad is \quad odd \quad \frac{n-1}{2} \quad will \quad give \quad the \quad number \quad of \quad terms \quad just \quad before \quad the \quad middle \quad term$

$Hence \quad a + \frac{n-1}{2}d \quad will \quad give \quad the \quad middle \quad term, \quad but \quad given \quad middle \quad term \quad is \quad m.$

$Hence \quad we \quad get \quad m = a + \frac{n-1}{2}d\ldots..(ii)$

$Now \quad from \quad (i) \quad and \quad (ii) \quad we \quad get \quad S_n = nm$

118. (b)
24

Explanation:
$The \quad given \quad sequence \quad can \quad be \quad expressed \quad as \quad T_1 = T_2 = 1$
$T_n = T_{n-1} + T_{n-2} + T_{n-3} \quad ,n \geq 3$
$\therefore \quad T_7 = T_6 + T_5 + T_4 = 13 + 7 + 4 = 24$

119. (a)
3

Explanation:
$Let \quad d \quad be \quad the \quad common \quad ratio \quad of \quad the \quad G.P$
$Given \quad S_8 = \quad 82 \quad S_4$
$\Rightarrow \frac{S_8}{S_4} = 82$
$We \quad have \quad S_n = \frac{a(r^n-1)}{r-1}$
$\Rightarrow \frac{\frac{a\left(r^8-1\right)}{r-1}}{\frac{a\left(r^4-1\right)}{r-1}} = 82, r-1 \neq 0$
$\Rightarrow \frac{r^8-1}{r^4-1} = 82$
$\Rightarrow r^8 - 1 - 82r^4 + 82 = 0$
$\Rightarrow \left(r^4\right)^2 - 82r^4 + 81 = 0$
$\Rightarrow \left(r^4\right)^2 - 81r^4 - 1r^4 + 81 = 0$
$\Rightarrow r^4\left(r^4-1\right) - 81\left(r^4-1\right) = 0$
$\Rightarrow \left(r^4-81\right)\left(r^4-1\right) = 0$
$\Rightarrow r^4 = 81 \quad or \quad r^4 = 1$
$Since \quad r-1 \neq 0 \quad , \quad r \quad cannot \quad be \quad 1$
$\Rightarrow r = \sqrt[4]{81} = 3$

120. (d)
3

Explanation:
$Let \quad r \quad be \quad the \quad common \quad ratio \quad of \quad the \quad G.P$
$Given \quad S_{10} = \quad 244 \quad S_5$
$\Rightarrow \frac{S_{10}}{S_5} = 244$
$We \quad have \quad S_n = \frac{a(r^n-1)}{r-1}$
$\Rightarrow \frac{\frac{a\left(r^{10}-1\right)}{r-1}}{\frac{a\left(r^5-1\right)}{r-1}} = 244, r-1 \neq 0$
$\Rightarrow \frac{r^{10}-1}{r^5-1} = 244$
$\Rightarrow r^{10} - 1 - 244r^5 + 244 = 0$
$\Rightarrow \left(r^5\right)^2 - 244r^5 + 243 = 0$
$\Rightarrow \left(r^5\right)^2 - 243r^5 - 1r^5 + 243 = 0$
$\Rightarrow r^5\left(r^5-1\right) - 243\left(r^5-1\right) = 0$
$\Rightarrow \left(r^5-243\right)\left(r^5-1\right) = 0$
$\Rightarrow r^5 = 243 \quad or \quad r^5 = 1$
$Since \quad r-1 \neq 0 \quad , \quad r \quad cannot \quad be \quad 1$
$\Rightarrow r = \sqrt[5]{243} = 3$