Atomic Energy Central School No. 4, Rawatbhata

Class XI (Physics, Chemistry, Mathematics/Biology)

Multiple Choice Questions Examination - July (2019-20)

Name of student:_____Class:_____ Roll No._____

General Instructions:1. Darken the appropriate circle in the OMR answer sheet.
2. Each question carries 1 mark. There is no negative marking.

Physics

1. A physical quantity P is related to four observables a, b, c and d as follows : **1**

$P = \frac{a^3b^2}{\sqrt{c}d}$ The percentage errors of measurement in a, b, c and d are 1%, 3%, 4% and 2%,respectively. What is the percentage error in the quantity P?

a) 15% b) 13%

c) 12% d) 11%

2. In SI system the fundamental units are **1**

a) meter, kilogram, second, ampere, Kelvin, mole and watt

b) meter, Newton, second, ampere, Kelvin, mole and candela

c) meter, kilogram, second, coulomb, Kelvin, mole and candela, horse power

d) meter, kilogram, second, ampere, Kelvin, mole and candela

3. Joule is the SI unit of **1**

a) power b) acceleration

c) force d) work

4. The number of significant digits in 6.032 N $\mathbf{m}^{-2}$ is **1**

a) 6 b) 3

c) 4 d) 5

5. The number of significant digits in 48,923 is **1**

a) 2 b) 4

c) 5 d) 3

6. Fundamental or base quantities are arbitrary. In SI system these are **1**

a) length, mass, force, electric current, thermodynamic temperature, amount of substance, and luminous intensity

b) as length, mass, time, electric charge, thermodynamic temperature, amount of substance, and luminous intensity

c) length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity

d) length, force, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity

7. A physical quantity P is related to four observables a, b, c and d as follows: **1**

$P = \frac{a^3b^2}{\sqrt{c}d}$ The percentage errors of measurement in a, b, c and d are 1%, 3%, 4% and 2%, respectively. If the value of P calculated using the above relation turns out to be 3.763, to what value should you round off the result?

a) 3.71

b) 4.0

c) 3.8

d) 3.76

8. One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). What is the ratio of molar volume to the atomic volume of a mole of hydrogen? (Take the size of hydrogen molecule to be about 1 Å). **1**

a) $\cong 10^3$

b) $\cong 10^4$

c) $\cong 10^2$

d) $\cong 10^5$

9. If θ is the parallax angle of a planet at a distance 'D', when observed from two different positions on the Earth, separated by distance 'b', the expression for 'D' is **1**

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

b) $\frac{\theta}{2b}$

c) $\frac{2b}{\theta}$

d) $\frac{b}{\theta}$

10. Derived units **1**

a) are units of physical quantity that can be expressed as multiples of fundamental physical quantities

b) are units of physical quantity that cannot be expressed as a combination of fundamental physical quantities

c) are units of physical quantity that can be expressed as a combination of fundamental physical quantities

d) are units of physical quantity that can not be expressed as multiples of fundamental physical quantities

11. The significant digits in 0.000532 are **1**

a) 5, 3, 2

b) 2, 3

c) 0,5,3,2

d) 5, 3

12. The result of rounding off 34.216 to 3 digits is **1**

a) 3.42

b) 34.2

c) 34.22

d) 342

13. The mass of a box measured by a grocer's balance is 2.300 kg. Two gold pieces of masses 20.15 g and 20.17 g are added to the box. What is the difference in the masses of the pieces to correct significant figures? **1**

a) 0.01 g
b) 0.02 g
c) 0.019 g
d) 0.022 g

14. Dimensional analysis can be used to **1**

a) check the validity of an equation
b) deducing relations among the physical quantities
c) To check integration of the equation
d) check the order of an equation

15. Percentage error δa is given by **1**

a) $\delta a = (\Delta a_{mean}/a_{mean})\ 80\%$
b) $\delta a = (\Delta a_{mean}/a_{mean})100\%$
c) $\delta a = (\Delta a_{mean}/a_{mean})70\%$
d) $\delta a = (\Delta a_{mean}/a_{mean})\ 200\%$

16. Measurement of a physical quantity is essentially the **1**

a) process of comparing with a standard using an instrument
b) process of observing the physical quantity
c) process of taking readings on an instrument
d) process of subdividing the physical quantity

17. Physical quantities are **1**

a) quantities such as kilos, pounds and gallons
b) quantities such as length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity
c) quantities such as pounds, dollars and rupees
d) quantities such as degrees, radians and steradians

18. The length, breadth and thickness of a rectangular sheet of metal are 4.234 m, 1.005 m, and 2.01 cm respectively. Give the area of the sheet to correct significant figures. **1**

a) 8.722 m^2
b) 8.72 m^2
c) 8.7221 m^2
d) 8.8 m^2

19. Estimate the average mass density of a sodium atom assuming its size to be about 2.5 $\overset{0}{A}$. (Use the known values of Avogadro's number and the atomic mass of sodium). Compare it with the density of sodium in its crystalline **1**

phase: 970 kgm^{-3}. Are the two densities of the same order of magnitude? If so, why?

a) $\cong 4.67 \times 10^3 kgm^{-3}$. In the solid phase atoms are tightly packed, so atomic mass density is not close to the mass density of the solid.

b) $\cong 0.78 \times 10^3 kgm^{-3}$. In the solid phase atoms are tightly packed, so atomic mass density is close to the mass density of the solid

c) $\cong 0.7 \times 10^7 kgm^{-3}$. In the solid phase atoms are tightly packed, so atomic mass density is close to the mass density of the solid

d) $\cong 0.75 \times 10^3 kgm^{-3}$. In the solid phase atoms are tightly packed, so atomic mass density is close to the mass density of the solid

20. The number of significant digits in 900.06 is **1**

a) 4 b) 1

c) 3 d) 5

21. For one dimensional motion displacement is the **1**

a) change in position: $\Delta x = x_2 - x_1$

b) change in position: $\Delta x = (x_2 + x_1)/2$

c) change in position: $\Delta x = x_2 + x_1$

d) $\Delta x = 2(x_2 + x_1)$

22. A drag racer starts her car from rest and accelerates at 10.0 m/s^2 for the entire distance of 400 m .How long did it take the race car to travel this distance in s? **1**

a) 9.01 b) 8.33

c) 10.2 d) 8.94

23. A stone thrown from the top of a building is given an initial velocity of 20.0 m/s straight upward. Determine the time in seconds at which the stone reaches its maximum height. g =9.8 m / sec^2 **1**

a) 2.8 b) 2.04

c) 1.67 d) 2.7

24. A truck has a velocity of 2 m /s at time t=0. It accelerates at 2 m / s^2 on seeing police .What is its velocity in m/s at a time of 2 sec **1**

a) 6 b) 3

c) 4 d) 7

25. A particle moves along the x axis. Its position is given by the equation $x = 2.00 + 3.00t - 4.00t^2$ with x in meters and t in seconds. Determine its position in m at the instant it changes direction **1**

a) 3.21 b) 1.97

c) 2.22 d) 2.56

26. A truck covers 40.0 m in 8.50 s while smoothly slowing down to a final speed of 2.80 m/s. Find its acceleration in $\mathbf{m/s^2}$ **1**

a) -0.448 b) -0.368

c) -0.3878 d) -0.4756

27. A stone thrown from the top of a building is given an initial velocity of 20.0 m/s straight upward. Determine the maximum height it travels in meters. g =9.8 m / $\mathbf{sec^2}$ **1**

a) 15.4 b) 25.4

c) 30.4 d) 20.4

28. A jet lands on an aircraft carrier at 30 m/s. It stops in 2.0 s? What is the displacement of the plane in m while it is stopping? **1**

a) 45 b) 30

c) 35 d) 40

29. Path length is a **1**

a) tensor b) Derived unit

c) scalar d) vector

30. A stone thrown from the top of a building is given an initial velocity of 20.0 m/s straight upward. Determine the time in seconds at which the stone returns to the height from which it was thrown. **1**
g = 9.8 m / $\mathbf{sec^2}$

a) 4.08 b) 3.45

c) 4.44 d) 5.32

31. A truck has a velocity of 3 m /s at time t=0. It accelerates at 3 m / $\mathbf{s^2}$ on seeing police .What is its velocity in m/s at a time of 2 sec **1**

a) 7 b) 9

c) 12 d) 8

32. Instantaneous velocity or simply velocity v at an instant t equals **1**

a) $\lim_{t \to 0} \frac{\Delta x}{\Delta t}$ b) $\lim_{t \to \infty} \frac{\Delta x}{\Delta t}$

c) $\lim_{t \to 0} \frac{\Delta x}{2\Delta t}$ d) $\lim_{t \to 1} \frac{\Delta x}{\Delta t}$

33. A jet lands on an aircraft carrier at 30 m/s. What is its acceleration if it stops in 2.0 s? **1**

a) 20 $\mathbf{ms^{-2}}$ b) -20 $\mathbf{ms^{-2}}$

c) -15 $\mathbf{ms^{-2}}$ d) -10 $\mathbf{ms^{-2}}$

34. A truck accelerates at 1 m / $\mathbf{sec^2}$ from rest. What is its velocity in m/s at a time of 2 sec? **1**

a) 2 b) 4

c) 1 d) 3

35. Average velocity is defined as **1**

a) the change in path length ($\mathbf{\Delta x}$) divided by the time intervals ($\mathbf{\Delta t}$), in which the displacement occurs

b) the change in average path length ($\mathbf{\Delta x}$) divided by the time intervals ($\mathbf{\Delta t}$), in which the displacement occurs

c) the change in average distance from origin ($\mathbf{\Delta x}$) divided by the time intervals ($\mathbf{\Delta t}$), in which the displacement occurs

d) the change in position or displacement ($\mathbf{\Delta x}$) divided by the time intervals ($\mathbf{\Delta t}$), in which the displacement occurs

36. Two parallel rail tracks run north-south. Train A moves north with a speed of 54 km/ hr, and train B moves south with a speed of 90 km/ hr. What is the velocity of a monkey running on the roof of the train A against its motion (with a velocity of 36 km/hr with respect to the train A) as observed by a man standing on the ground in m/s ? Choose the positive direction of x-axis to be from south to north **1**

a) 5.0 b) 3

c) 8 d) 11

37. A particle moves along the x axis. Its position is given by the equation $x = 2.00 + 3.00t - 4.00t^2$ with x in meters and t in seconds. Determine its velocity in m/s when it returns to the position it had at t = 0. **1**

a) -2.54 b) -3.0

c) -2.75 d) -4.02

38. A truck on a straight road starts from rest, accelerating at 2.00 $\mathbf{m/s^2}$ until it reaches a speed of 20.0 m/s. Then the truck travels for 20.0 s at constant speed until the brakes are applied, stopping the truck in a uniform manner in an additional 5.00 s. What is the average velocity in m/s of the truck for the motion described? **1**

a) 15.7 b) 16.2

c) 154 d) 17.5

39. A stone thrown from the top of a building is given an initial velocity of 20.0 m/s straight upward. The height of the building is 50.0 m. determine the velocity in m/sec when the stone hits the ground. g =9.8 m / $\mathbf{sec}^2$ **1**

a) -27.4 b) -33.8

c) -39.7 d) -37.1

40. A truck covers 40.0 m in 8.50 s while smoothly slowing down to a final speed of 2.80 m/s. Find its original speed in m/s **1**

a) 6.61 b) 8.61

c) 5.61 d) 7.61

Chemistry

41. According to Avogadro Law equal volumes ofall gases at the same temperature and pressure should contain ---------- number of molecules . **1**

a) similar b) equal

c) different d) unequal

42. SI unit of density is **1**

a) kg m^{-2} b) kg m^{-3}

c) kg m^3 d) $kg^{-1}m^3$

43. There are ___m in 2000 mm? **1**

a) 20 m b) 0.002 m

c) 2 m d) 0.02 m

44. Choose the one out of the following having the highest mass, **1**

a) 3.011×10^{22} atoms of oxygen b) 1 g atom of C

c) $\frac{1}{2}$ mole of CH_4 d) 10 mL of water

45. For the reaction **1**

Fe_2O_3 (s) + 3 CO (g) $\rightarrow$ 2 Fe (g) + 3 CO_2,

224 g of CO is available to react with 400 g Fe_2O_3, the yield of iron and CO_2, are ---------- and ----------respectively:

a) 210 g , 279 g b) 279 g , 330 g

c) 225 g , 279 g d) 210 g ,290 g

46. 30.4 cm = ---------- mm.: **1**

a) 0.304 mm b) .0.030 mm

c) 304 mm. d) 3.04 mm

47. There are ___ L in 12.0 ml? **1**

a) 0.10 L b) 0.012 L

c) 0.12 L d) 0.0012 L

48. The kelvin scale is related to celsius scale as : **1**

a) K = °C + 100 b) K = °C + 273.15

c) K = °C + 212 d) K = °C + 32

49. The number of significant figures in 0.0101 is **1**

a) 4 b) 2

c) 3 d) 5

50. How many atoms of hydrogen are in 67.2 L of H at STP? **1**

a) 5.612×10^{24} b) 2.612×10^{24}

c) 3.612×10^{24} d) 4.612×10^{24}

51. Molecular formula represents **1**

a) ratio of masses of various atoms present in a compound

b) whole number ratio of different types of atoms present in a molecule of a compound

c) average fractionall ratio of various atoms present in a compound

d) the exact number of different types of atoms present in a molecule of a compound

52. Molecular mass of glucose $C_6H_{12}O_6$) is **1**

a) 180. 162 u b) 198.162 u

c) 206.162 u. d) 192.162 u

53. The gram molar mass of $CaCO_3$ is **1**

a) 50 g b) 100

c) 150 u d) 100 g

54. The molarity of NaOH in a solution prepared by dissolving its 4.0 g in enough water to form 250 mL of the solution is , **1**

a) 0.002 M b) 0.4 M

c) 0.04M d) 0.02 M

55. The calculation of masses or, (sometimes volumes also) of the reactants and the products involved in a chemical reaction is called **1**

a) molarity
b) stoichiometry
c) normality
d) molality

56. 5.6 litres of oxygen at NTP is equivalent to: **1**

a) $\frac{1}{4}$ mole
b) $\frac{1}{8}$ mole
c) $\frac{1}{2}$ mole
d) 1 mole

57. There are ____ L in 0.05 ml? **1**

a) 0.50 L
b) 0.0005 liters
c) 0.00005 L
d) 5.0 liters

58. A given compound always contains exactly the same proportion of elements by weight. This law is stated by **1**

a) Dalton
b) Proust
c) Avagadro
d) Gay Lussac

59. There are ____ cms. in 0.101 mm . ? **1**

a) 0.101 cms.
b) 1.010 cm
c) 0.0101 cms.
d) 10.10 cm

60. For the reaction **1**

$2N_2H_4(l) + N_2O_4(l) \rightarrow 3N_2(g) + 4H_2O(l)$,

Which is the limiting reagent for this reaction?

a) N_2H_4
b) N_2O_4
c) N_2
d) H_2O

61. The energy associated with the first orbit in the hydrogen atom is -2.18 x 10^{-18} J/atom. What is the energy associated with the fifth orbit? **1**

a) -7.72 $\times 10^{-20}$ J/atom
b) -5.72 $\times 10^{-20}$ J/atom
c) -3.72 $\times 10^{-20}$ J/atom
d) -8.68 $\times 10^{-20}$ J/atom

62. Quantum mechanics is a theoretical science that deals with the study of the **1**

a) motions of the microscopic objects that have only particle like properties
b) motions of the macroscopic objects that have both observable wave like and particle like properties
c) motions of the microscopic objects that have both observable wave like and particle like properties
d) motions of the macroscopic objects that have only particle like properties

63. A model of atom in which the idea of orbits associated with definite energies was first given by **1**

a) Rutherford
b) James Chadwick
c) Neils Bohr
d) J.J. Thomson

64. Oil drop experiment is for determining the **1**

a) deviation of the electron.
b) mass of the electron
c) number of electrons
d) charge on the electrons

65. Around 10 Hz corresponds to the region of the electromagnetic spectrum **1**

a) ultraviolet region
b) infrared region
c) visible light
d) microwave region

66. Due to the presence of electrons in the inner shells, the electron in the outer shell will not experience the full positive charge of the nucleus (Z_e). This is known as **1**

a) shielding of the outer shell electrons from the nucleus by the inner shell electrons
b) charge stealing by inner shell electrons from the outer shell electrons
c) charge stealing by outer shell electrons from the inner shell electrons
d) shielding of the inner shell electrons from the nucleus by the outer shell electrons

67. An element with mass number 81 contains 31.7 % more neutrons as compared to protons. Assign the atomic symbol. **1**

a) $^{81}_{35}\mathrm{Cl}$
b) $^{81}_{35}\mathrm{Ag}$
c) $^{81}_{35}\mathrm{S}$
d) $^{81}_{35}\mathrm{Br}$

68. The electronic configuration $1s^2 2s^2 2p^1$ belongs to **1**

a) Boron
b) carbon
c) Beryllium
d) lithium

69. In the emission spectrum of hydrogen atom, the Balmer series falls in the **1**

a) Ultraviolet region
b) X - ray region
c) Infra-red region
d) visible region

70. Which of the following orbitals are not possible? **1**

a) 3s
b) 3p
c) 4d
d) 3f

71. de-Broglie equation is **1**

a) $\lambda = \frac{hv}{m}$
b) $\lambda = \frac{mv}{h}$
c) λ = hmv
d) $\lambda = \frac{h}{mv}$

72. The electrons are ejected from the metal surface as soon as the beam of light strikes the surface is called **1**

a) Faraday's cathode ray discharge model
b) Thomson model for electron
c) Photoelectric effect
d) Planck's quantum theory

73. In an atom, the maximum number of electrons in an orbit / principal energy level n is **1**

a) $2n^2$
b) 2n
c) 2n-1
d) n^2

74. Give the number of electrons in the species, 2 and O_2^+. **1**

a) 16 and 8
b) 16 and 14
c) 16 and 15
d) 32 and 16

75. Wave number of yellow radiations having wavelength of 5800 A^0. **1**

a) 1.72 x $10^2 m^{-1}$
b) 1.72 x $10^5 m^{-1}$
c) 1.72 x $10^6 m^{-1}$
d) 1.72 x $10^3 m^{-1}$

76. Energy of an electron in stationary state is given by the formula **1**

$E_{n^m} R_H \left(1 - \frac{1}{n^2}\right)$

where n = 1,2,3..... In this equation, R_H is called

a) Rydberg's constant
b) Planck's constant
c) Proportionality constant
d) Avagadro's Number

77. The wavelength of a ball of mass 0.1 kg moving with a velocity of 10 ms will be **1**

a) 7.626×10^{-34} m
b) 6.626×10^{-34} m
c) 6.626×10^{34} m
d) 6.626×10^{-35} m

78. Radio frequency region of the electromagnetic spectrum is used for broadcasting. It is **1**

a) Around 10^6 Hz
b) Around 10^{15} Hz
c) Around 10^{13} Hz
d) Around 10^{10} Hz

79. An atom of an element contains 29 electrons and 35 neutrons. The electronic configuration of an element **1**

a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$
b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ 4s^2\ 3d^6\ 4s^2\ 4p^2$
c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ 4s^1\ 3d^9\ 4s^2$
d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ 4s^2\ 3d^8\ 4s^2$

80. The commonly occurring isotopes of carbon atoms are: ^{12}C, $_6{}^{13}C$, $_6{}^{14}C$. They **1**

contain:

a) 7, 8 and 9 neutrons 6 protons

b) 6, 8 and 9 neutrons and 6 protons

c) 6, 7 and 9 neutrons and 6 protons

d) 6, 7 and 8 neutrons and 6 protons

Mathematics

81. Sets A and B have 3 and 6 elements respectively. What can be the maximum number of elements in A B.

a) 3

b) 9

c) 18

d) 6

82. If A, B and C are any three sets , then $A \cap (B \cup C)$ is equal to

a) $(A - B) \cap (A - C)$

b) $(A \cap B) \cup (A \cap C)$

c) $(A \cup B) \cap (A \cap C)$

d) $(A \cup B) \cup (A \cup C)$

83. P (A) = P (B) $\nRightarrow$

a) $B \subseteq A$

b) A = B

c) $B \supseteq A$

d) $B \subset A$

84. Given the sets A = { 1, 2, 3 } , B = { 3 , 4 } , C = { 4 , 5, 6 } , then A (B C) is

a) {1, 2, 3}

b) { 3 }

c) { 1, 2 ,3 , 4, 5, 6 }

d) { 1, 2 , 3 , 4 }

85. If A = {x : x is a multiple of 3,x natural no.,x<30} and B = {x : x is a multiple of 5,x is natural no.,x<30} then A - B is

a) $\{3, 6, 9, 12, 15, 18, 21, 24, 27, 30\}$

b) $\{3, 6, 9, 12, 18, 21, 24, 27\}$

c) $\{3, 5, 6, 9, 10, 12, 15, 18, 20, 21, 24, 25, 27, 30\}$

d) $\{5, 10, 15, 20, 25, 30\}$

86. If a set A has n elements then the total number of subsets of A is

a) 2n

b) n

c) 2^n

d) n^2.

87. The number of non-empty subsets of the set { 1, 2, 3, 4 }is :

a) 14

b) 16

c) 17 d) 15

88. Which set is the subset of all given sets ?

a) { 1 } b) { 0 }

c) { 1,2,3,4 } d) { }

89. For any two sets A and B, (A - B) (B - A) = ...

a) $(A \cup B) - (A \cap B)$ b) $(B - A) \cup B$

c) $(B - A) \cup B$ d) $(A \cup B) \cap (A \cap B)$

90. Which of the following is (A – B) (A – C) ?

a) A ∩ (B –C) b) A – (B ∩C)

c) (A ∪ B) ∪(A ∩ B) d) (A - B) ∪C

91. Out of 800 boys in a school, 224 played cricket , 240 played hockey and 336 played basketball . Of the total, 64 played both basketball and hockey ; 80 played cricket and basketball and 40 played cricket and hockey ; 24 played all the three games . The number of boys who did not play any game is :

a) 160 b) 128

c) 150 d) 240

92. Which of the following is a set?

a) The collection of most talented writers of India is a set.

b) The collection of good cricket players of India is a set.

c) A collection of vowels in English alphabets is a set.

d) The collection of most difficult topics in Mathematics is a set.

93. The range of the function f (x) = cos (x/3) is

a) [- 1, 1] b) $\left[-\frac{1}{3}, \frac{1}{3}\right]$

c) [-3, 3] d) none of these

94. In a city 20 percent of the population travels by car, 50 percent travels by bus and 10 percent travels by both car and bus. Then persons travelling by a car or bus is

a) 60 percent b) 80 percent

c) 70 percent d) 40 percent

95. Consider the following relations: 1. A – B = A – $A \cap B$) 2. A = $(A \cap B) \cup$(A – B). 3. A – (B ∪ C) = (A – B) ∪ (A – C). Which of these is/are correct?

a) 2 only b) 1 and 3

c) 1 and 2 d) 2 and 3

96. If f : $R \to R$and g : $R \to R$are defined by f (x) = 2x + 3 and g(x) = $x^2 + 7$, then the values of x such that g (f (x)) = 8 are

a) - 1, - 2 b) - 1, 2

c) 1, 2 d) 1, - 2

97. Two finite sets have m and n elements. The number o elements in the power set of the first is 48 more than the total number of elements in the power set of the second. Then the values of m and n are

a) 6, 4 b) 6, 3

c) 3, 7 d) 7, 6

98. If f : R $\to$ R is given by f (x) = | x | and $A = \{x \in R : x < 0\}$, then $f^{-1}(A)$ equals

a) ϕ b) A

c) $A \cup \{0\}$ d) R

99. The relation R = {1, 1), (2, 2), (3, 3)} on the set {1, 2, 3) is

a) an equivalence relation b) reflexive only

c) symmetric only d) transitive only

100. If f $R \to R$ satisfies f (x + y) = f (x) + f (y) for all x, y $\in$ R and f (1) = 7, then $\sum_{r=1}^{n} f(r)$ is

a) 7 n(n +1) b) $\frac{7(n+1)}{2}$

c) $\frac{7n(n+1)}{2}$ d) $\frac{7n}{2}$

101. The minimum value of (x -) (x –) is

a) $-\frac{1}{4}(\alpha - \beta)^2$ b) $\alpha\beta$

c) $\frac{1}{4}(\alpha - \beta)^2$ d) 0

102. If f (x) = $\frac{x-1}{x+1}$, then $\left(f\frac{1}{f(x)}\right)$ equals

a) 0 b) 1

c) x d) $\frac{1}{x}$

103. Let $f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2}, x \neq 0,$ then f(x) =

a) $x^2 - 2$ b) $x^2 - 1$

c) x^2 d) $x^2 + 1$

104. If A = $\{x : x^2 - 5x + 6 = 0\}$, B = {2, 4}, C = {4, 5} then $A \times (B \cap C)$ is

a) {(4, 2), (4, 3)} b) {(2, 2), (3, 3), (4, 4), (5, 5)}

c) {(2, 4), (3, 4), (4, 4)} d) {(2,4), (3, 4)}

105. In a ΔABC, tan $\frac{A}{2} = \frac{5}{6}$ and $\frac{C}{2} = \frac{2}{5}$, then

a) None of these b) a, b, c are in A.P.

c) a,b,c are in H.P d) a, b, c are in G.P.

106. The value of the expression tan 1^o tan 2^o tan 3^o ... tan 89^o is equal to

a) 0 b) not defined

c) ∞ d) 1

107. The maximum value of $\sin\left(x + \frac{\pi}{6}\right) + \cos\left(x + \frac{\pi}{6}\right)$ in the interval $\left(0, \frac{\pi}{2}\right)$ is attained at

a) $\frac{\pi}{3}$ b) $\frac{\pi}{6}$

c) $\frac{\pi}{2}$ d) $\frac{\pi}{12}$

108. The general value of satisfying sin = - and tan = $\frac{1}{\sqrt{3}}$ is

a) $n\pi + \frac{\pi}{6}, n \in I$ b) $n\pi + (-1)^n \frac{7\pi}{6}, n \in I$

c) $2n\pi + \frac{7\pi}{6}, n \in I$ d) $2n\pi + \frac{11\pi}{6}, n \in I$

109. The value of $\sin\frac{\pi}{14} \sin\frac{3\pi}{14} \sin\frac{5\pi}{14} \sin\frac{7\pi}{14} \sin\frac{9\pi}{14} \sin\frac{11\pi}{14} \sin\frac{13\pi}{14}$ is

a) none of these b) $\frac{1}{128}$

c) $\frac{1}{64}$ d) $\frac{1}{16}$

110. The equation $\sin x - \frac{\pi}{2} + 1 = 0$ has no root in the interval

a) $\left(0, \frac{\pi}{2}\right)$ b) none of these

c) $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$ d) $\left(\frac{\pi}{2}, \pi\right)$

111. The general solution of the equation sin x + cos x = 2 is

a) $2\ n\ \pi + \frac{\pi}{2} or\ 2n\ \pi, n \in I$ b) $2\ n\ \pi + \frac{\pi}{2} or\ 2n\ \pi, n \in I$

c) $n\ \pi, n \in I$ d) no solution

112. The equation (cos p – 1) x^2 + (cos p) x + sin p = 0, where x is a variable, has rea roots. Then the interval of p may be any one of the following:

a) $(0, \pi)$ b) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

c) $(0, \pi)$ d) $(-\pi, 0)$

113.If $\sin\theta + \text{cosec}\theta$ = 2, then $\sin^2\theta + \cos ec^2\theta =$

a) 2 b) 1

c) none of these d) 4

114.In a ΔABC, a = 4, b = 3 and A = 60° ; then c is a root of the equation

a) $c^2 - 3c + 7 = 0$ b) $c^2 + 3c + 7 = 0$

c) $c^2 - 3c - 7 = 0$ d) $c^2 - 3c - 8 = 0$

115. If $sin\alpha = \sin\beta$ and $\cos\alpha = \cos\beta$, then

a) $\sin(\alpha + \beta) = 0$ b) $\cos(\alpha + \beta) = 0$

c) $\sin(\alpha - \beta) = 0$ d) $\cos(\alpha - \beta) = 0$

116. The largest value of $\sin\theta\cos\theta$ is

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

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

117. The domain of the function $\sqrt{\cos x - 1}$ is

a) none of these b) $\{2n\pi : n \in I\}$ c) $\{\}$ d) R

118. Let x be any real, then [x + y] = [x] + [y] holds for

a) $y \in I$ b) $y \in R$ c) $y \in R, y \in Q$. d) $y \in Q$

119. The range of the function $f(x)=\frac{x^2-3x+2}{x^2+x-6}$ is

a) R – {1} b) R−{1/5} c) R−{1,1/5} d) R

120. Which of the following is a null set?

a) $\{ x : x^2+1=0, x \in R \}$ b) { 0 }

c) { x : x > 0 or x < 0 } d) $\{ x : x^2 = 4$ or x = 3 }

Solution

Class 11 - Physics

Unit Test 1 (2019-20)

Section A

1. (b)

   13%

   Explanation:

   P = $\frac{a^3b^2}{\sqrt{c}\,d}$

   Maximum fractional error in P is given by

   $\frac{\Delta P}{P} = \pm\left(3\frac{\Delta a}{a} + 2\frac{\Delta b}{b} + \frac{1}{3}\frac{\Delta c}{c} + \frac{\Delta d}{d}\right)$

   $=> \frac{\Delta P}{P} = \pm\left(3\frac{1}{100} + 2\frac{3}{100} + \frac{1}{2}\frac{4}{100} + \frac{2}{100}\right) => \frac{\Delta P}{P} = \pm 0.13$

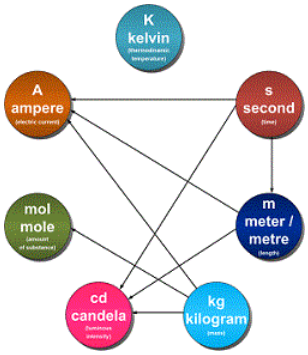
   Percentage error in P = $\frac{\Delta P}{P} \times 100 = 0.13 \times 100 = 13\%$

2. (d)

   meter, kilogram, second, ampere, Kelvin, mole and candela

   Explanation:

   The SI base units and their physical quantities are the metre for measurement of length, the kilogram for mass, the second for time, the ampere for electric current, the kelvin for temperature, the candela for luminous intensity, and the mole for amount of substance.

3. (d)

   work

   Explanation:

   The joule (symbol J), is a derived unit of energy in the International System of Units. It is equal to the energy transferred to (or work done on) an object when

a force of one newton acts on that object in the direction of its motion through a distance of one metre (1 newton metre or N·m).

4. (c)
   4

   Explanation:
   There are three rules on determining how many significant figures are in a number:
   - Non-zero digits are always significant.
   - Any zeros between two significant digits are significant.
   - A final zero or trailing zeros in the decimal portion ONLY are significant.

   So keeping these rules in mind, there are 4 significant digit.

5. (c)
   5

   Explanation:
   There are three rules on determining how many significant figures are in a number:
   - Non-zero digits are always significant.
   - Any zeros between two significant digits are significant.
   - A final zero or trailing zeros in the decimal portion ONLY are significant.

   Keeping these rules in mind, we can say that there are 5 significant digits.

6. (c)
   length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity

   Explanation:
   A base quantity is chosen and arbitrarily defined, rather than being derived from a combination of other physical quantities. The 7 base quantities are:

PHYSICAL QUANTITY	**BASE SI UNIT**
Mass (m)	Kilogram (Kg)
Length (ll)	Metre (m)
Time (t)	Second (s)

Current (II)	Ampere (A)
Temperature (T)	Kelvin (K)
Amount of sub. (n)	Molar (mol)
Luminous Intensity (L)	Candela (cd

7. (c)

   3.8

   Explanation:

   Value of P is given as 3.763.

   By rounding off the given value to the first decimal place,

   we get P = 3.8.

8. (b)

   $\cong 10^4$

   Explanation:

   Radius of hydrogen atom, r = 0.5 = 0.5 × 10^{-10} m

   Volume of hydrogen atom = $\frac{4}{3} \times \frac{22}{7} \times \left(0.5 \times 10^{-10}\right)^3$

   = $0.524 \times 10^{-30} m^3$

   Now, 1 mole of hydrogen contains 6.023 × 10^{23} hydrogen atoms.

   Volume of 1 mole of hydrogen atoms, V_a = 6.023 × 10^{23} × 0.524 × 10^{-30}

   = 3.16 × 10^{-7} m^3

   Molar volume of 1 mole of hydrogen atoms at STP,

   V_m = 22.4 L = 22.4 × 10^{-3} m^3

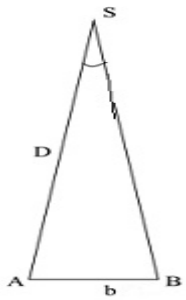
   => $\frac{V_m}{V_a} = \frac{22.4 \times 10^{-3}}{3.16 \times 10^{-7}}$ = 7.08 $\times 10^{-4}$

   = $\cong 10^{-4}$

9. (d)

   $\frac{b}{\theta}$

   Explanation:



Parallax Method of Measurement: Astronomers use an effect called parallax to measure distances to nearby stars. Parallax is the apparent displacement of an object because of a change in the observer's point of view.

To measure the distance D of a far away planet S by the parallax method, We observe it from two different positions (observatories) A and B on the Earth, separated by distance AB = b at the same time as shown in the given figure. We measure the angle between the two directions along which the planet is viewed at these two points. The ∠ASB in the figure represented by symbol θ is called the parallax angle or parallactic angle.

As the planet is very far away, bD<<1 and therefore, θ is very small. Then we approximately take AB as an arc of length b of a circle with center at S and the distance D as the radius AS = BS so that AB = b = Dθ where θ is in radians.

D= $\frac{b}{\theta}$

10. (c)

are units of physical quantity that can be expressed as a combination of fundamental physical quantities

Explanation:

Derived units are units which may be expressed in terms of base units by means of mathematical symbols of multiplication and division.

For example, the SI derived unit of area is the square metre (m^2), and the SI derived unit of density is the kilogram per cubic metre (kg/m^3 or $kg\ m^{-3}$).

The names of SI units are written in lowercase.

11. (a)

5, 3, 2

Explanation:

There are three rules on determining how many significant figures are in a number:

- Non-zero digits are always significant.
- Any zeros between two significant digits are significant.
- A final zero or trailing zeros in the decimal portion ONLY are significant.

Keeping these rules in mind, we can say that only 5,3,2 are significant digits.

12. (b)
    34.2

    Explanation:
    The rules for rounding off are following.
    - If the first non-significant digit is less than 5, then the least significant digit remains unchanged.
    - If the first non-significant digit is greater than 5, the least significant digit is incremented by 1.
    - If the first non-significant digit is 5, the least significant digit can either be incremented or left unchanged.
    - All non-significant digits are removed.

    So rounding off 34.216 upto 4 digits is 34.22 and upto 3 digits is 34.2

13. (b)
    0.02 g

    Explanation:
    Difference in masses = 20.17 – 20.15 = 0.02 g
    In subtraction, the final result should retain as many decimal places as there are in the number with the least decimal places.

14. (b)
    deducing relations among the physical quantities

    Explanation:
    Dimensional analysis is also used to deduce the relation between two or more physical quantities.
    If we know the degree of dependence of a physical quantity on another, that is the degree to which one quantity changes with the change in another, we can use the principle of consistency of two expressions to find the equation relating these two quantities.

15. (b)

$\delta a = (\Delta a_{mean}/a_{mean})100\%$

Explanation:

Percentage Error: It is the relative error measured in percentage.

So Percentage Error $\delta a = \frac{mean\ absolute\ value}{mean\ value} \times 100\%$

$\delta a = \frac{\Delta a_{mean}}{a_{mean}} \times 100\%$

16. (a)

process of comparing with a standard using an instrument

Explanation:

The Measurement of a given quantity is essentially an act or result of comparison between a quantity whose magnitude (amount) is unknown, with a similar quantity whose magnitude (amount) is known, the latter quantity being called a Standard.

17. (b)

quantities such as length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity

Explanation:

A physical quantity is a physical property of a phenomenon, body, or substance, that can be quantified by measurement.A physical quantity can be expressed as the combination of a magnitude expressed by a number – usually a real number – and a unit.

All these given above can be expressed as explained so these are physical quantity.

18. (b)

8.72 m^2

Explanation:

length, l = 4.234 m

breadth,b = 1.005 m

thickness, t = 2.01 cm = 2.01 × 10^{-2} m Area of the sheet = 2 (l × b + b × t + t × l) = 2 (4.234 × 1.005 + 1.005 × 0.0201 + 0.0201 × 4.234) = 2 (4.3604739) = 8.7209478 m^2

As area can contain a maximum of three significant digits, therefore, rounding off, we get Area = 8.72 m^2

19. (a)

$\cong 4.67 \times 10^3 kgm^{-3}$. In the solid phase atoms are tightly packed, so atomic mass density is not close to the mass density of the solid.

Explanation:

Diameter of sodium atom = 2.5 A°

Radius of sodium atom r = 1.25A° = $1.25 \times 10^{-10} m$

Atomic Volume = Total Volume $\times$No of molecules

= $\frac{4}{3}\pi r^3 \times N$

$= \frac{4}{3} \times \frac{22}{7} \times (1.25 \times 10^{-10}) \times 6.023 \times 10^{23}$

= $4.93 \times 10^{-6} m^3$

Mass of sodium atom = 23 g = $23 \times 10^{-3} kg$

Average mass density = $\frac{Mass}{volume}$

= $\frac{23 \times 10^{-3}}{4.93 \times 10^{-6}}$ = $4.67 \times 10^3 kgm^{-3}$

Hence, the density of sodium atom and the density of sodium in its crystalline phase are not in the same order. This is because in solid phase, atoms are closely packed. Thus, the inter-atomic separation is very small in the crystalline phase.

20. (d)

5

Explanation:

There are three rules on determining how many significant figures are in a number:

- Non-zero digits are always significant.
- Any zeros between two significant digits are significant.
- A final zero or trailing zeros in the decimal portion ONLY are significant.

Keeping these rules in mind, we can say that there are 5 significant digits.

21. (a)

change in position: $\Delta \mathrm{x} = \mathrm{x}_2 - \mathrm{x}_1$

Explanation:

Displacement is defined to be the change in position of an object. It can be defined mathematically with the following equation:

$Displacement = \Delta x = x_2 - x_1$

x_2 refers to the value of the final position.

x_1 refers to the value of the initial position.

Δx is the symbol used to represent displacement.

22. (d)

8.94

Explanation:

Initial velocity u = 0

Acceleration a = 10.0 m/s^2

Distance covered s = 400 m

Time taken t = ?

We know

$s = ut + \frac{1}{2}at^2$

$=> 400 = 0 \times t + \frac{1}{2} \times 10 \times t^2$

$=> 400 = 5t^2$

$=> t^2 = 80$

$=> t = \sqrt{80} = 8.94\ s$

23. (b)

2.04

Explanation:

Initial velocity u = 20.0 m/s

At maximum height it ll stop

So final velocity v = 0 m/s

Acceleration due to gravity g = 9.8 m/s^2

Time taken to reach maximum height = t

We know

v = u + at

$=> 0 = 20 + (-9.8)t$

$=> t = \frac{-20}{-9.8} = 2.04\ s$ [g is taken negative because it is in opposite direction of motion.]

24. (a)

6

Explanation:

Initial velocity u = 2 m/s

final velocity = v m/s

Time duration = final time - initial time = 2-0 = 2 s

acceleration a = 2 m/s^2

We know,

v = u + at

=> v = $2 + 2 \times 2$

=> v = 6 m/s

25. (d)

2.56

Explanation:

it will change direction When the speed is zero.

Velocity v = $\frac{dx}{dt} = 3 - 8t$

Put v = 0, we get

$=> 3 - 8t = 0$

$=> t = \frac{3}{8}$

It ll change direction at $t = \frac{3}{8}$

Position at this time.

$x(\frac{3}{8}) = 2 + 3(\frac{3}{8}) - 4(\frac{3}{8})^2$

= $2 + \frac{9}{8} - \frac{9}{16}$

= $\frac{32+18-9}{16}$

= $\frac{41}{16}$

= 2.56 m

26. (a)

-0.448

Explanation:

Let initial velocity = u

Final velocity v = 2.80 m/s

Distance covered s = 40.0 m

Time taken t = 8.50 s

We know,

v = u + at

=> v-u = at .....(1)

Also

$s = ut + \frac{1}{2}at^2$

From (1) put value of at, we get

$=> s = ut + \frac{1}{2}t(v - u)$

$=> s = ut + \frac{1}{2}tv - \frac{1}{2}ut$

$=> s = \frac{1}{2}ut + \frac{1}{2}tv$

Put all the given values, we get

$=> 40 = \frac{1}{2} \times u \times 8.5 + \frac{1}{2} \times 2.8 \times 8.5$

$=> 80 - 23.8 = 8.5u$

$=> 8.5u = 56.2$

$=> u = 6.61\ m/s$

Put value of u in (1), we get

$=> 2.8 - 6.61 = 8.5a$

$=> 8.5a = -3.81$

$=> a = -0.448\ m/s^2$

Negative sign shows velocity is decreasing.

27. (d)

20.4

Explanation:

Initial velocity u = 20.0 m/s

At maximum height stone ll be stopped,

So final velocity v = 0 m/s

Acceleration due to gravity a = g =

-9.8 m/s^2 (-ve Because it is in opposite direction of motion)

Let maximum height = s

We know,

$v^2 - u^2 = 2as$

=> $0^2 - (20)^2 = 2 \times (-9.8)s$

$=> -400 = -19.6s$

$=> s = \frac{-400}{-19.6} = 20.4\ m$

28. (b)

30

Explanation:

Initial velocity u = 30 m/s

As it stop so final velocity v = 0 m/s

Time t = 2 s

Distance covered = s

We know,

s = $\frac{1}{2}(u + v)t$

$=> s = \frac{1}{2}(30 + 0) \times 2$

=> s = 30 m

29. (c)

scalar

Explanation:

Path length has no particular direction and it depends upon the path chosen to reach the destination where displacement of the destination is absolute no matter what path is used to get there. So it is scaler.

30. (a)

4.08

Explanation:

Initial velocity u = 20.0 m/s

At maximum height stone ll be stopped,

So final velocity v = 0 m/s

Acceleration due to gravity a = g =

-9.8 m/s^2 (-ve Because it is in opposite direction of motion)

Let maximum height = s

We know,

$v^2 - u^2 = 2as$

=> $0^2 - (20)^2 = 2 \times (-9.8)s$

$=> -400 = -19.6s$

$=> s = \frac{-400}{-19.6} = 20.4\ m$

Time to cover this distance upward is given by

$=> v - u = at$

=> 0-20= (-9.8)t

=> t = $\frac{-20}{-9.8} = 2.04\ sec$

Again to reach same level from where it has been thrown it have to cover same distance downward.

For this initial velocity u = 0

s = 20.4 m

a = 9.8 m/s^2 (+be because motion is in same direction).

So,

$=> 20.4 = 0 \times t + \frac{1}{2} \times 9.8t^2$

$=> t^2 = \frac{20.4}{4.9} = 4.16$

$=> t = \sqrt{4.16} = 2.04$

Total time = 2.04 + 2.04= 4.08 s

31. (b)

9

Explanation:

Initial velocity u = 3 m/s

Acceleration a = 3 m/s^2

Initial time $t_1 = 0\ s$

Final time $t_2 = 2\ s$

Time taken t = 2-0= 2 s

Final velocity v = ?

We know,

$v = u + at$

$=> v = 3 + 2 \times 3$

$=> v = 3 + 6 = 9\ m/s^2$

32. (a)

$\lim_{t \to 0} \frac{\Delta x}{\Delta t}$

Explanation:

Instantaneous velocity is the velocity of an object in motion at a specific point in time. This is determined similarly to average velocity, but we narrow the period of time so that it approaches zero.

The formula for instantaneous velocity is the limit as t approaches zero of the change in position over the change in t.

Mathematically,

$\lim_{t \to 0} \frac{\Delta x}{\Delta t}$

Where x is the given function with respect to time t. The Instantaneous Velocity is expressed in m/s.

33. (c)

-15 ms^{-2}

Explanation:

Initial velocity u = 30 m/s

As it stops then final velocity v = 0 m/s

Time taken t = 2.0 s

We know,

v-u = at

=> 0-30= 2a

=> a = $\frac{-30}{2} = -15\ m/s^2$

-ve sign shows velocity is decreasing.

34. (a)

2

Explanation:

Initial velocity u = 0 m/s

final velocity = v

Time t = 2 s

Acceleration a = 1 m/s^2

We know,

v = u + at

$=> v = 0 + 1 \times 2$

=> v = 2 m/s

35. (d)

the change in position or displacement (Δx) divided by the time intervals (Δt), in which the displacement occurs

Explanation:
Average velocity is the displacement of an object, divided by the time it took to cover that distance.
$V_{average} = \frac{\Delta x}{\Delta t}$
Displacement is the straight line distance between the starting point and ending point of an object's motion.
Velocity is referred to as a vector quantity because it has both magnitude and direction.

36. (a)
5.0

Explanation:
Choose the positive direction of x-axis to be from south to north.
Then, $v_A = +54\ kmh^{-1} = \ +15\ ms^{-1}$
$v_B = \ -90\ kmh^{-1} = \ -25\ ms^{-1}$
Relative velocity of B with respect to A $= v_B - v_A = 15 - (-25) = 40\ ms^{-1}$,
i.e. the train B appears to A to move with a speed of 40 ms^{-1} from north to south.
Relative velocity of ground with respect to B
$= 0 - v_B = 0 - (-25) = 25 ms^{-1}$
Now, let the velocity of the monkey with respect to ground be v_M.
Relative velocity of the monkey with respect to A,
$v_{MA} = v_M - v_A = -18 kmh^{-1} = -5 ms^{-1}$

37. (b)
-3.0

Explanation:
$x = 2.00 + 3.00t - 4.00t^2$
At t = 0, we have x = 2,
$2 = 2 + 3.0t\text{-}4t^2$
=> t(3-4t) = 0

=> t = 0 and t = $\frac{3}{4}$

Velocity v = $\frac{dx}{dt} = 3 - 8t$

= 3 - $8 \times \frac{3}{4}$

= 3-6 = -3 m/s

Negative sign shows direction of velocity is opposite.

38. (a)

15.7

Explanation:

As start from rest,

So Initial velocity u = 0 m/s

Final velocity v = 20 m/s

Acceleration a = 2 m/s^2

Let Time during this period = t_1

Also let distance covered $= s_1$

We know,

v-u = at

So, $20 - 0 = 2t_1$

$t_1 = \frac{20}{2} = 10\ s$

Also,

$v^2 - u^2 = 2as_1$

$=> 400 - 0 = 2 \times 2 \times s_1$

$s_1 = \frac{400}{4} = 100\ m$

Now travel with constant speed of 20 m/s for time $t_2 = 20\ s$

Distance covered $s_2 = 20 \times 20 = 400\ m$

Time taken to stop $t_3 = 5\ s$

Before stopping it covers distance $= s_3$

$s_3 = \frac{1}{2}(20 - 0)5 = 50\ m$

Total distance covered = 100+400+50 = 550 m

Total time of motion t= 10+20+5 = 35 s

Average velocity $v_{avg} = \frac{total\ distance}{total\ time}$

$= \frac{550}{35}$ = 15.7 m/s

39. (d)

-37.1

Explanation:

When the stone ll reach at the same point from where is was thrown it ll have same velocity but with opposite sign.

So initial velocity u = -20 m/s

Final velocity before hitting ground = v

Distance covered s = 50 m

Acceleration due to gravity a = 9.8 m/s^2

We know

$v^2 - u^2 = 2as$

$=> v^2 - (-20)^2 = 2 \times 9.8 \times 50$

$=> v^2 - 400 = 980$

$=> v^2 = 1380$

$=> v = \sqrt{1380} = \pm 37.1$

As this velocity is in opposite direction is initial velocity so sign ll be negative.

v = -37.1 m/s

40. (a)

6.61

Explanation:

Let initial velocity = u

Final velocity v = 2.80 m/s

Distance covered s = 40.0 m

Time taken t = 8.50 s

We know,

v = u + at

=> v-u = at .....(1)

Also

$s = ut + \frac{1}{2}at^2$

From (1) put value of at, we get

$=> s = ut + \frac{1}{2}t(v - u)$

$=> s = ut + \frac{1}{2}tv - \frac{1}{2}ut$

$=> s = \frac{1}{2}ut + \frac{1}{2}tv$

Put all the given values, we get

$=> 40 = \frac{1}{2} \times u \times 8.5 + \frac{1}{2} \times 2.8 \times 8.5$

$$=> 80 - 23.8 = 8.5u$$
$$=> 8.5u = 56.2$$
$$=> u = 6.61\ m/s$$

Solution

Class 11 - Chemistry

MCQ-(2019-20)

Section A

41. (b)

    equal

    Explanation:

    Avogadro's law states that " equal volumes of all gases at same temperature and pressure contain **equal** number of molecules. "

42. (b)

    kg m^{-3}

    Explanation:

    Since, density

    = mass / volume ;

    and SI unit of mass is kg and that of volume is m^3

    ∴ using these SI units the unit of density is derived through dimensional analysis :

    density = mass / volume

    = kg / m^3

    or, = **kg m^{-3}**

43. (c)

    2 m

    Explanation:

    Since , 1 m

    =1000 mm.

    or, 1 mm

    = $\frac{1}{1000}m$

    ∴**2000 mm**

    =[$\frac{1}{1000}X2000$] m

    = **2 m**

44. (b)

1 g atom of C

Explanation:

Calculations & inference :

1 g atom of C

1 gm atomic mass of C

= 12.00 g

One mole of CH_4

= gram molar mass of CH_4

= 16 g

$\therefore$ mass of $\frac{1}{2}$ mole of CH_4 = 8.0 g

Mass of 10 ml of water

= 10 gms

(since , density of water = 1 gm / ml)

Mass of 6.022×10^{22} atoms of Oxygen

Since, 6.022×10^{23} atoms of Oxygen weighs

= its gm atomic mass (ie.16 g)

$\therefore$mass of 3.011×10^{23} atoms of O

= 8 .0 g.

$\therefore$ mass of 3.011×10^{22} atoms of O

= 0.80 g

Thus , the mass of 1 g atom of Carbon is highest out of the above .

45. (b)

279 g , 330 g

Explanation:

<u>Calculations :</u>

i. Convert the amounts given into number of moles ,

Moles of CO

= $(\frac{224}{28})$

=8 moles

Moles of Fe_2O_3

= ($\frac{400}{159.69}$)

= 2.50 moles.

ii. Stoichiometric calculations ,

3 moles of CO is needed for 1 mole of Fe_2O_3

∴ 8 moles of CO will require

= $\frac{8X1}{3}$ = $\frac{8\times1}{3}$ mole

= 2.66 mole of Fe_2O_3,

Thus it is inferred that a lesser number of moles of Fe_2O_3 has been taken to react & hence Fe_2O_3 is limiting reagent.

Again , 1 mole of Fe_2O_3 produces 2 mole of Fe

∴ 2.5 mole of Fe_2O_3 will produce

= (2.5 $\times$ 2) moles of Fe

= 5 moles of Fe

= (molar mass of Fe $\times$ 5) g

= $(55.845 \times 5)g$

= 279.23 g of Fe

or $\approx$ **279 g of Fe.**

Further , 1 mole of Fe_2O_3 produces 3 mole of CO_2

∴ 2.5 mole of Fe_2O_3 will produce

= (3 $\times$ 2.5) moles of CO_2]

7.5 mole of CO_2

∴ mass of CO_2

= (7.5 $\times$ molar mass of CO_2) g

= $(7.5 \times 44)g$

=**330g.of CO_2**

46. (c)

304 mm.

Explanation:

Since,

1cm

=10 mm

∴ **30.4 cm**

= **(30.4 x 10) mm.**

= **304 mm.**

47. (b)

0.012 L

Explanation:

Since , 1L

=1000 ml

$\therefore$ 12 ml

= $\frac{12}{1000}$ L

= 0.012 L

48. (b)

K = °C + 273.15

Explanation:

The relation between Kelvin scale & Celcius scale of temperatures is -

K = °C + 273.15

Such a relation is based upon the experimental findings and subsequent conclusion of Charle's law .

The Kelvin scale is also termed as " absolute scale of temperature."

It is interesting to note that temperature below 0^{o} C (ie. negative values) are possible in Celcius scale but in Kelvin scale , negative temperature is not possible .

49. (c)

3

Explanation:

Zero/s preceding to first non-zero digit is non- significant.

Hence , **the number of significant digit in 0.0101 is 3**

50. (c)

3.612×10^{24}

Explanation:

Calculations

Step 1

Number of moles of H_2 in 67.2 L of H_2

$=\frac{67.2}{22.4}$

=3 moles

Step 2 /

Number of molecules in 1 moles of H_2

=6.02 x 10^{23} molecules of H_2

Since H_2 is a diatomic gas the number of atoms in 1 mole of H_2

= (2 x 6.02 x 10^{23})

= 12.04 x 10^{23} atoms of H atoms

(since , one molecule of H_2 contains 2 atoms).

∴ Number of atoms in 3 moles of H_2

= (3 x 12.04 x 10^{23})

=3.612x 10^{24} atoms of H.

51. (d)

the exact number of different types of atoms present in a molecule of a compound

Explanation:

Molecular formula is the exact no. of atoms present in a molecule of a compound.

Molecular formula of a compound is related with its empirical formula as ,

Mollecular formula = (Empirical formula) $_n$

where n represents a positive integer .

52. (a)

180. 162 u

Explanation:

Molecular mass of Glucose is calculated using the relation :

Molecular mass

= $\sum$ (6*atomic mass of C , 12* atomic mass of H , 6* atomic mass of O) u

∴ substituting the respective atomic masses we get ,

Molecular mass of glucose ($C_6 H_{12} O_6$)

= **[6(12.0107)+12(1.008)+6(15.9994)]**

= **180.162 u**.

53. (d)

100 g

Explanation:

The gram molar mass of Ca CO_3 is calculated by ,

(i) adding up the atomic masses of Ca , C & 3 O atoms & ,

(ii) representing the molar mass in grams.

Thus , gram molar mass of Ca C O_3

= Σ [atomic mass of Ca , atomic mass of C , 3 x atomic mass of O]

= $[40 + 12 + (3X16)]g$

= (40 + 12 + 48) g

=**100g**

It should be noted that ,

atomic mass of Ca

= 12

atomic mass of C

= 12

atomic mass of O

= 16

54. (b)

0.4 M

Explanation:

Since , Molarity

= $[\frac{molesofsolute*}{volumeofsolution(mL)}X1000]M$

∴ substituting the given values , we get -

Molarity (M)

= $\frac{0.10}{250}X1000M$

=**0.4M**

***** moles of solute ie. NaOH = $\frac{4}{40}$ mole

.= 0.1mol

55. (b)

stoichiometry

Explanation:
Stoichiometry is a method to express quantitative aspects of a chemical reaction .
Usually , the masses of reactants as well as those of products in a chemical reaction are calculated using corresponding balanced chemical equation .
It is convenient and hence desirable to calculate volumes of gaseous reactants and products .

56. (a)
$\frac{1}{4}$mole

Explanation:
Since , 22.4 litres of oxygen
$\equiv$ 1 mole of oxygen
$\therefore$ 5.6 litres of oxygen
$\equiv$ { $\frac{1*5.6}{22.4}$] moles of oxygen
$\equiv \frac{1}{4}$ mole

57. (c)
0.00005 L

Explanation:
Since , 1L
= 1000mL
or , 1mL
= $\frac{1}{1000}L$.
$\therefore$ **0.05mL**
= $\frac{1}{1000}X0.05L$
= **0.00005 L** .

58. (b)
Proust

Explanation:
The observation was first made by French chemist Joseph Proust , based on certain experiments conducted between 1798 and 1804.

Proust made the above statement known as " Proust's law " or " Law of definite composition " or " Law of constant composition "

59. (c)

0.0101 cms.

Explanation:

Since , 10 mm.

= 1 cm.

∴.0.101 mm .

= $\frac{1X0.101}{10} cms.$

= **0.0101 cms.**

60. (b)

N_2O_4

Explanation:

Chemical reactions rarely occur completely when exactly the right amounts of reactants are taken to react together to yield products as per its stoichiometry. One of the reactants will be used up, before another runs out. Thus, the reactant which is consumed first is known as limiting reagent

For the given reaction ,

$2N_2H_4$ (l) + N_2O_4 (l) $\rightarrow$ $3N_2$ (g) + $4H_2O$ (l)

as per its stoichiometry, if only the right and exact amount of N_2O_4 is taken, the reaction may not go to completion. As such it would be consumed first & is, therefore, the **limiting reagent.**

61. (d)

-8.68 $\times 10^{-20}$ J/atom

Explanation:

The energy of first (Bohr) orbit in hydrogen atom = $-2.17 \times 10^{-18}\ Jatom^{-1}$

Energy of fifth orbit will be given by $E_n = E_1 \times \frac{Z^2}{N^2}$

$E_5 = \frac{-2.17 \times 10^{-18}}{5^2} = 8.68 \times 10^{-20} Jatom^{-1}$

62. (c)

motions of the microscopic objects that have both observable wave like and particle like properties

Explanation:
quantum mechanics, science dealing with the behaviour of matter and light on the atomic and subatomic scale. It attempts to describe and account for the properties of molecules and atoms and their constituents—electrons, protons, neutrons, and other more esoteric particles such as quarks and gluons. These properties include the interactions of the particles with one another and with electromagnetic radiation (i.e., light, X-rays, and gamma rays).

63. (c)
Neils Bohr

Explanation:
In 1913 Neils Bohr proposed a model of hydrogen atom based on the quantum theory of radiations. According to this, the electron in the hydrogen atom revolves around the nucleus only in certain selected circular orbits.

64. (d)
charge on the electrons

Explanation:
The oil drop experiment was performed by Robert A. Millikan and Harvey Fletcher in 1909 to measure the elementary electric charge (the charge of the electron). The experiment entailed observing tiny electrically charged droplets of oil located between two parallel metal surfaces, forming the plates of a capacitor.

65. (c)
visible light

Explanation:
Electromagnetic radiation in this range of wavelengths is called visible light or simply light. A typical human eye will respond to wavelengths from about 390 to 700 nm. In terms of frequency, this corresponds to a band in the vicinity of 430–770 THz.

66. (a)

shielding of the outer shell electrons from the nucleus by the inner shell electrons

Explanation:
Shielding effect can be defined as a reduction in the effective nuclear charge on the electron cloud, due to a difference in the attraction forces of the electrons on the nucleus. It is also referred to as the screening effect (or) atomic shielding.

67. (d)
$^{81}_{35}\mathrm{Br}$

Explanation:
P+N =81
N=P+(0.317)P
Solving these two equation we get P=35
Atomic number of Bromine is 35.
So symbol is
$^{81}_{35}\mathrm{Br}$

68. (a)
Boron

Explanation:
Boron is a chemical element with symbol B and atomic number 5. So electronic configuration of boron is $1s^2 2s^2 2p^1$

69. (d)
visible region

Explanation:
The spectral lines obtained as a result of transition of electrons from higher energy levels to the second energy level of a hydrogen atom give rise to Balmer Series which is in the visible region of electromagnetic spectrum.

70. (d)
3f

Explanation:

if n=3 then l = 0,1,2 i.e. only 3s,3p,3d orbitals are possible.

71. (d)

$\lambda = \frac{h}{mv}$

Explanation:

Louis de-Broglie proposed that matter, like light , has a dual character.It exhibits wave as well as particle nature. The wavelength of the wave associated with a particle of mass m moving with velocity v is given by

$\lambda = \frac{h}{mv}$

72. (c)

Photoelectric effect

Explanation:

The photoelectric effect is the emission of electrons or other free carriers when light is shone onto a material. Electrons emitted in this manner can be called photo electrons.

73. (a)

$2n^2$

Explanation:

Since the maximum number of electrons in each orbital is 2, the maximum number of electrons in an entire quantum level is $2n^2$.

74. (c)

16 and 15

Explanation:

atomic number O has atomic number = 8 so number of electrons in O_2 = 16 while in O_2^+ there is one unit positive charge so no. of electron =15.

75. (c)

1.72 x $10^6 m^{-1}$

Explanation:

Wave number is defined as the reciprocal of wavelength.

$\bar{\nu} = \frac{1}{\lambda}$

where, λ = wavelength = 5800 Å = $5.8 \times 10^{-7} m$

So, $\bar{\nu} = \frac{1}{5.8 \times 10^{-7}} = 1.72 \times 10^{6} m^{-1}$

76. (a)

Rydberg's constant

Explanation:

The Rydberg constant, symbol R_∞ for heavy atoms or R_H for hydrogen, named after the Swedish physicist Johannes Rydberg, is a physical constant relating to atomic spectra, in the science of spectroscopy.

77. (b)

6.626×10^{-34} m

Explanation:

Given : mass = 0.1 kg Veloctiy = 10 m/s We know

$\lambda = \frac{h}{mv}$

Where h is Planck's constant.

$\lambda = \frac{6.626 \times 10^{-34}}{10 \times 0.1} = 6.626 \times 10^{-34}$ m

78. (a)

Around 10^6 Hz

Explanation:

Radio frequency (RF) is any of the electromagnetic wave frequencies that lie in the range extending from around3 kHz to 300 GHz, which include those frequencies used in radio communication or radar. RF usually refers to electrical rather than mechanical oscillations

79. (a)

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

Explanation:

No of electron = No of protons

So electronic configuration = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

80. (d)

6, 7 and 8 neutrons and 6 protons

Explanation:

Isotopes are atoms with the same number of protons but that have a different number of neutrons.

Atomic number of carbon = 6

So number of protons in each isotope = 6

Number of neutrons in ${}^{12}_{6}C$= 12-6= 6

Number of neutrons in ${}^{13}_{6}C$= 13-6= 7

Number of neutrons in ${}^{14}_{6}C$= 14-6= 8

Solution

Class 11 - Mathematics

mcq

Section A

81. (b)

9

Explanation:

n(A ∪ B)= n(A) +n(B)-n(A ∩B)

if n(A∩B) =0 then n(A ∪ B) is max.

so max. number of element in A ∪ B = 9

82. (b)

(A ∩ B) ∪(A ∩C)

Explanation:

$Let\ x\ \in\ A\ \cup\ (B\ \cap\ C).$

$x\ \in\ A\ or\ x\ \in\ (B\ and\ C)$

$x\ \in\ A\ or\ \{x\ \in\ B\ and\ x\ \in\ C\}$

$\{x\ \in\ A\ or\ x\ \in\ B\}\ and\ \{x\ \in\ A\ or\ x\ \in\ C\}$

$x\ \in\ (A\ or\ B)\ and\ x\ \in\ (A\ or\ C)$

$x\ \in\ (A\ \cup\ B)\ \cap\ x\ \in\ (A\ \cap\ C)$

$x\ \in\ (A\ \cup\ B)\ \cap\ (A\ \cup\ C)$

$Therefore,\ \ A\ \cup\ (B\ \cap\ C)\ \subset\ (A\ \cup\ B)\ \cap\ (A\ \cup\ C).....(1)$

$similarly$

$(A\ \cup\ B)\ \cap\ (A\ \cup\ C)\ \subset\ A\ \cup\ (B\ \cap\ C).....(2)$

so

$A\ \cup\ (B\ \cap\ C)\ =\ (A\ \cup\ B)\ \cap\ (A\ \cup\ C)$

83. (b)

A = B

Explanation:

$To\ \ prove\ \ A=B\ \ it\ \ is\ \ enough\ \ to\ \ prove\ \ \ \ B\subseteq A\ \ \ and\ \ \ A\subseteq B$

$So\ \ let\ \ \ P(A)=P(B)$

$Also\ \ \ let\ \ \ x\in A$

$Now\ \ \ we\ \ \ have\ \ \ A\in P(A)$

$\Rightarrow A\in P(B),\ \ \ since\ \ \ P(A)=P(B)$

$\therefore x\in E\ \ \ for\ \ \ some\ \ \ E\in P(B)$

$Now\ \ \ E\subset B$

$\Rightarrow x\in B$

$Hence\ \ \ we\ \ \ proved\ \ \ A\subseteq B$

$Similarly\ \ \ by\ \ \ taking\ \ \ x\in B\ \ \ and\ \ \ showing\ \ \ x\in A\ \ \ we\ \ \ get\ \ \ B\subseteq A$

$Hence\ \ \ A=B$

84. (d)

{ 1, 2 , 3 , 4 }

Explanation:

$Given A=\{1,2,3\}, B=\{3,4\}\ and\ C=\{4,5,6\}$

$B\cap C=\{4\}$

$A\cup(B\cap C)=\{1,2,3,4\}$

85. (b)

$\{3,6,9,12,18,21,24,27\}$

Explanation:

since set B represent multiple of 5 so from Set A common multiple of 3 and 5 are excluded

86. (c)
2^n

Explanation:

The total no of subsets=2^n

87. (d)
15

Explanation:
total no of subset including empty set = 2^n
so total subset = 2^4 = 16
the no of non empty set = 16- 1 = 15

88. (d)
{ }

Explanation:
{ } denoted as null set.
and Null set is subset of all sets.

89. (a)
$(A \cup B) - (A \cap B)$

Explanation:
$x \in (A - B) \cup (B - A) \Rightarrow (x \in A, x \notin B) or (x \in B, x \notin A)$
$\Rightarrow x \in (A \cup B), x \notin (A \cap B)$
$\Rightarrow x \in (A \cup B) - (A \cap B)$

90. (b)
A – (B ∩C)

Explanation:
$Let \quad x \in A - (B \cap C) \Rightarrow x \in A \quad and \quad x \notin B \cap C$
$\Rightarrow x \in A \quad and \quad (x \notin B \quad or \quad x \notin A)$
$\Rightarrow (x \in A \quad and \quad x \notin B \quad) \quad or \quad (x \in A \quad and \quad x \notin C)$
$\Rightarrow x \in A - B \quad or \quad x \in A - C$
$\Rightarrow x \in (A - B) \cup (A - C)$
$\Rightarrow A - (B \cap C) \subset (A - B) \cup (A - C) \ldots\ldots (i)$
$Now \quad let \quad y \in (A - B) \cup (A - C)$
$\Rightarrow y \in A - B \quad or \quad y \in A - C$
$\Rightarrow (y \in A \quad and \quad y \notin B \quad) \quad or \quad (y \in A \quad and \quad y \notin C)$
$\Rightarrow y \in A \quad and \quad (y \notin B \quad or \quad y \notin A)$
$\Rightarrow y \in A \quad and \quad y \notin B \cap C$
$\Rightarrow y \in A - (B \cap C)$
$\Rightarrow (A - B) \cup (A - C) \subset A - (B \cap C) \ldots\ldots (ii)$
$From \quad (i) \quad and \quad (ii) \quad we \quad get A - (B \cap C) = (A - B) \cup (A - C)$

91. (a)
160

Explanation:

$Let\ \ U\ \ denote\ \ the\ \ set\ \ of\ \ boys\ \ in\ \ a\ \ school\ \ and\ \ let\ \ C, HandBdenote\ \ the\ \ sets\ \ of\ \ boys$
$Then\ \ we\ \ have\ \ n(U) = 800\ \ \ , n(C) = 224\ \ \ , n(H) = 240\ \ \ and\ \ \ n(B) = 336$
$Also\ \ \ n(C \cap H) = 40\ \ \ , n(B \cap H) = 64\ \ \ \ \ n(C \cap B) = 80\ \ \ and\ \ \ n(C \cap B \cap H) = 24$
$Now\ \ we\ \ have\ \ n(C \cup H \cup B) = n(C) + n(H) + n(B) - n(C \cap H) - n(B \cap H) - n(C \cap B) + n(C \cap B \cap H)$
$\Rightarrow n(C \cup H \cup B) = 224 + 240 + 336 - 40 - 64 - 80 + 24$
$\Rightarrow n(C \cup H \cup B) = 640$
$Which\ \ means\ \ the\ \ number\ \ of\ \ boys\ \ who\ \ play\ \ any\ \ one\ \ game\ \ \ \ \ = 640$
$Hence\ \ the\ \ number\ \ of\ \ boys\ \ who\ \ Did\ \ not\ \ play\ \ any\ \ game\ \ \ = n(U) - n(C \cup H \cup B) = 800 - 64$

92. (c)

A collection of vowels in English alphabets is a set.

Explanation:

The set is{a,e,i,o,u}

93. (a)

[- 1, 1]

Explanation:

Since the cosine function takes values between

- 1 and 1 including - 1 and 1 also.

$\therefore$ range of given function = [-1,1]

94. (a)

60 percent

Explanation:

Let A denote the set of persons travelling bu car, B denotes the set of persons travelling by bus, then

$n(A)\ =\ 20,\ n(B)\ =\ 50,\ n(A \cap B)\ =\ 10$

$\therefore\ n(A \cup B)\ =\ n(A) + n(B) - n(A \cap B)$

= 20 + 50 - 10 = 60

95. (c)

1 and 2

Explanation:

(I) $A - (A \cap B) = A \cap (A \cap B')\ [\because A - B = A \cap B']$

$= A \cap (A' \cap B')$ [By De - morgan's law]

$= (A \cap A') \cup (A \cap B')$

$= \phi \cup (A \cap B') = A \cap B' = A - B$

(II) $(A \cap B) \cap (A - B) = (A \cap B) \cup (A \cap B')$

$= X \cup (A \cap B')$ Where X = $A \cap B$

$= (X \cup A) \cap (X \cup B')$

$=\ \mathrm{A} \cap (\ \mathrm{A} \cup \mathrm{B}')\ [\ \mathrm{X} \cup \mathrm{A}\ =\ (\mathrm{A} \cap \mathrm{B}) \cup \mathrm{A}\ =\ \mathrm{A}(\because \mathrm{A\ B}\ \subset \mathrm{A}\ )\ \mathrm{X}\ \cup \mathrm{B}'\ =\ (\ \mathrm{A} \cap \mathrm{B}) \cup \mathrm{B}'\ =(\ \mathrm{A} \cup \mathrm{B}') \cap (\mathrm{B} \cup \mathrm{B}$

$=\mathrm{A}\ [\because\ \mathrm{A} \subset\ \mathrm{A} \cup\ \mathrm{B}']$

(III) This is correct because,

$A - (B \cup C) = (A - B) \cap (A - C)$

96. (a)

- 1, - 2

Explanation:

$\mathrm{g}\,(\mathrm{f}(\mathrm{x}))\ =\ \mathrm{g}\,(\ 2\mathrm{x}\ +3)\ =\ (2\mathrm{x}\ +3)^{2}\ +7$

$=\ 4\mathrm{x}^{2}\ +9\ +12\mathrm{x}\ +7\ =\ 4\mathrm{x}^{2}\ +12\mathrm{x}\ +\ 16$

$\therefore\ \mathrm{g}\,(\mathrm{f}(\mathrm{x}))\ =\ 8$

$\Rightarrow\ 4\mathrm{x}^{2}\ +12\mathrm{x}\ +\ 16\ =\ 8$

$\Rightarrow\ \mathrm{x}^{2}\ +3\mathrm{x}\ +\ 4\ =\ 2\ \Rightarrow\ \ \mathrm{x}^{2}\ +3\mathrm{x}\ +\ 2\ =\ 0$

$\Rightarrow x^2 + 2x + x + 2 = 0$

$\Rightarrow x((x+2) + 1(x+2)) = 0$

$\Rightarrow (x+1)(x+2) = 0 \Rightarrow x = -1, -2$

97. (a)

6, 4

Explanation:

Let A has m elements and B gas n elements. Then, no. of elements in

P(A) = 2^m and no. of elements in P(B) = 2^n.]

By the question,

$2^m = 2^n + 48$

$\Rightarrow 2^m - 2^n = 48$

This is possible, if $2^m = 64$, $2^n = 16$. (As 64 - 16 = 48)

$\therefore 2^m = 64 \Rightarrow 2^m = 2^6$

$\Rightarrow m = 6.$

Also, $2^4 = 16 \Rightarrow 2^4 = 2^4$

$\Rightarrow n = 4$

98. (a)

ϕ

Explanation:

Here, $A = \{x \in R : x < 0\} \subseteq co - domain$

$f^{-1}(A)$ Contains those elements in R(domain) whose image is negative

Since $f(x) = |x|$

$\therefore$ no image of any elements of R(domain) is negative

$\therefore f^{-1}(A) = \phi$

99. (a)

an equivalence relation

100. (c)

$\frac{7n(n+1)}{2}$

Explanation:

$Given \quad f(x+y) = f(x) + f(y) \ldots . (i)$

$and \quad f(1) = 7$

$Put \quad x = 1, y = 1 \quad in \quad equation(i), \quad we \quad obtain \quad f(1+1) = f(1) + f(1) = 14 \Rightarrow f(2) = 14$

$Similarly \quad f(1+1+1) = f(2) + f(1) = 14 + 7 \Rightarrow f(3) = 21$

$Since \quad we \quad have \quad f(1) = 1 \times 7 = 7, f(2) = 2 \times 7 = 14, f(3) = 3 \times 7 = 21, \ldots \ldots \ldots \ldots$

$we \quad can \quad get \quad f(n) = n \times 7 = 7n$

$Now \sum_{r=1}^{n} f(r) = f(1) + f(2) + f(3) + \ldots \ldots \ldots \ldots \ldots \ldots \ldots + f(n)$

$= \quad 7 + 14 + 21 + \ldots \ldots \ldots + 7n$

$= 7[1 + 2 + 3 + \ldots \ldots + n]$

$= 7\frac{n(n+1)}{2}$

101. (a)

$-\frac{1}{4}(\alpha - \beta)^2$

Explanation:

Let $f(x) = (x-\alpha)(x-\beta)$ then,

$f'(x) = (x-\alpha).1 + 1.(x-\beta)$

$\Rightarrow f'(x) = 2x - (\alpha + \beta)$

$\Rightarrow f''(x) = 2$

now, $f''(x) = 0 \Rightarrow 2x - (\alpha + \beta) = 0$

$\Rightarrow x = \frac{\alpha + \beta}{2}$

$At\ x = \frac{\alpha + \beta}{2},\ f''(x) = 2 > 0$

$\therefore\ x = \frac{\alpha + \beta}{2}$ is point of minimum value and minimum value is,

$f\left(\frac{\alpha + \beta}{2}\right) = \left(\frac{\alpha + \beta}{2} - \alpha\right)\ \left(\frac{\alpha + \beta}{2} - \beta\right)$

$= \left(\frac{\beta - \alpha}{2}\right)\ \left(\frac{\alpha - \beta}{2}\right) = -\frac{1}{4}(\alpha - \beta)^2$

102. (d)

$\frac{1}{x}$

Explanation:

We have $f(x) = \frac{x-1}{x+1}$ then

$f\left(\frac{1}{f(x)}\right) = \frac{\frac{1}{f(x)} - 1}{\frac{1}{f(x)} + 1} = \frac{1 - f(x)}{1 + f(x)}$

$= \frac{1 - \frac{x-1}{x+1}}{1 + \frac{x-1}{x+1}} = \frac{x+1-x+1}{x+1+x-1} = \frac{2}{2x} = \frac{1}{x}$

103. (a)

$x^2 - 2$

Explanation:

$\mathrm{f}\left(\mathrm{x} + \frac{1}{\mathrm{x}}\right) = \mathrm{x}^2 + \frac{1}{\mathrm{x}^2} = \left(\mathrm{x} + \frac{1}{\mathrm{x}}\right)^2 - 2$

$\therefore\ \mathrm{f}(\ \mathrm{x}) = \mathrm{x}^2 - 2$

104. (d)

{(2,4), (3, 4)}

Explanation:

$x^2 - 5x + 6 = 0$

$\Rightarrow x^2 - 2x - 3x + 6 = 0$

$\Rightarrow x(x-2) - 3(x-2) = 0$

$\Rightarrow (x-3)(x-2) = 0 \Rightarrow x = 2, 3$

$\therefore\ A = \{2, 3\}\ ;\ Also,\ B = \{2, 4\},\ c = \{4, 5\}$

Now, $B \cap C = \{4\}$

$\therefore\ A \times B \cap C = \{2, 3\} \times \{4\}$

$= \{(2, 4), (3, 4)\}$

105. (b)

a, b, c are in A.P.

Explanation:

$Given \quad tan\frac{A}{2} = \frac{5}{6} \quad and \quad tan\frac{C}{2} = \frac{2}{5}$

$But \quad we \quad have \quad tan\frac{A}{2}.tan\frac{C}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}} . \sqrt{\frac{(s-a)(s-b)}{s(s-c)}}$

$\therefore \quad \frac{5}{6}.\frac{2}{5} = \frac{(s-b)}{s}$

$\Rightarrow s = 3\,(s - b)$

$\Rightarrow 2\left(\frac{a+b+c}{2}\right) = 3b \qquad [\because \quad 2s = a + b + c \quad]$

$\Rightarrow a + c = 2b$

$\Rightarrow a, b, c \quad are \quad in \quad A.P$

106. (d)

1

Explanation:

Since tan 1 .tan 89 =1..... only tan 45 in the middle which has the value 1. hence the product is 1.

107. (d)

$\frac{\pi}{12}$

Explanation:

$sin\left(x+\frac{\pi}{6}\right)+cos\left(x+\frac{\pi}{6}\right)=sinx.cos\frac{\pi}{6}+cosx.sin\frac{\pi}{6}+cosx.cos\frac{\pi}{6}-sinx.sin\frac{\pi}{6}$

$=sinx.\frac{\sqrt{3}}{2}+cosx.\frac{1}{2}+cosx.\frac{\sqrt{3}}{2}-sinx.\frac{1}{2}$

$=\left(\frac{\sqrt{3}-1}{2}\right)sinx+\left(\frac{\sqrt{3}+1}{2}\right)cosx$

$=\sqrt{2}\left[sin15^\circ sinx+cos15^\circ cosx\right]$

$=\sqrt{2}\left[cos\left(x-15^\circ\right)\right]$

$But\quad we\quad have\quad the\quad maximum\quad value\quad of\quad cosx\quad is\quad 1, when\quad x=0$

$Hence\quad cos\left(x-15^\circ\right)takes\quad its\quad maximum\quad value\quad when\quad x-15^\circ=0\Longrightarrow x=15^\circ\Longrightarrow x=\frac{\pi}{12}$

108. (c)

$2n\pi+\frac{7\pi}{6}, n\in I$

Explanation:

$\sin\theta=\frac{-1}{2}$

$\Rightarrow\sin\theta=sin\left(-\frac{\pi}{6}\right)$

$\Rightarrow\theta=n\pi+(-1)^n\left(-\frac{\pi}{6}\right), n\epsilon Z$

$\Rightarrow\theta=\frac{7\pi}{6},\frac{11\pi}{6}$

$tan\theta=\frac{1}{\sqrt{3}}$

$\Rightarrow tan\quad\theta=tan\left(\frac{\pi}{6}\right)$

$\Rightarrow\theta=n\pi+\left(\frac{\pi}{6}\right), n\epsilon Z$

$\Rightarrow\theta=\quad\frac{\pi}{6},\frac{7\pi}{6}$

$So\quad principal\quad value\quad for\quad both\quad sin\theta\quad and\quad tan\theta\quad is\quad\frac{7\pi}{6}$

$Hence\quad the\quad general\quad solution\quad is\quad 2n\pi+\frac{7\pi}{6}, n\in I$

109. (c)

$\frac{1}{64}$

Explanation:

$First\ \ convert\ \ the\ \ odd\ \ multiples\ \ of\ \ \frac{\pi}{14}\ \ to\ \ even\ \ multiples\ \ \ using\ \ the\ \ formulas\ \ sin\theta = cc$
$So\ \ we\ \ get\ \ \ sin\frac{\pi}{14} = cos\frac{6\pi}{14}, sin\frac{3\pi}{14} = cos\frac{4\pi}{14}, sin\frac{5\pi}{14} = cos\frac{2\pi}{14}, sin\frac{7\pi}{14} = 1,$
$sin\frac{9\pi}{14} = sin\left(\frac{\pi}{2} + \frac{2\pi}{14}\right) = cos\frac{2\pi}{14}, sin\frac{11\pi}{14} = sin\left(\frac{\pi}{2} + \frac{4\pi}{14}\right) = \quad cos\frac{4\pi}{14}, sin\frac{13\pi}{14} = sin\left(\frac{\pi}{2} + \frac{6\pi}{14}\right) = cos\frac{6\pi}{14}$
$Now\ \ \ sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}\sin\frac{7\pi}{14}\sin\frac{9\pi}{14}\sin\frac{11\pi}{14}\sin\frac{13\pi}{14}$
$= cos^2\frac{6\pi}{14}.cos^2\frac{4\pi}{14}.cos^2\frac{2\pi}{14}$
$= \frac{\left(sin^2\frac{2\pi}{14}.cos^2\frac{2\pi}{14}\right).cos^2\frac{4\pi}{14}.cos^2\frac{6\pi}{14}}{sin^2\frac{2\pi}{14}} \qquad [\because \quad sin2x = 2sinx.cosx \quad]$
$= \frac{\frac{1}{4}sin^2\frac{4\pi}{14}.cos^2\frac{4\pi}{14}.cos^2\frac{6\pi}{14}}{sin^2\frac{2\pi}{14}}$
$= \frac{\frac{1}{4}.\frac{1}{4}.sin^2\frac{8\pi}{14}.cos^2\frac{6\pi}{14}}{sin^2\frac{2\pi}{14}} \qquad [\because \quad sin2x = 2sinx.cosx \quad]$
$= \frac{\frac{1}{16}.\left(sin\frac{8\pi}{14}.cos\frac{6\pi}{14}\right)^2}{sin^2\frac{2\pi}{14}}$
$= \frac{\frac{1}{16}.\left(\frac{1}{2}\right)^2.\left(sin\frac{14\pi}{14}+sin\frac{2\pi}{14}\right)^2}{sin^2\frac{2\pi}{14}} \qquad [\because \quad 2sinA.cosB = sin(A+B) + sin(A-B)]$
$= \frac{\frac{1}{64}.\left(0+sin\frac{2\pi}{14}\right)^2}{sin^2\frac{2\pi}{14}} \qquad [\because \quad sin\pi = 0 \quad]$
$= \frac{1}{64}$

110. (b)

none of these

Explanation:

Since sin x lies between -1 to 1 hence the given equation will lie between $(-\pi)/2to2 - \pi/2.$

111. (d)

no solution

Explanation:

Given $sinx + cosx = 2$.....(i)

This is of the form $acosx + bsinx = c$

Now divide the equation (i) throughout by $\sqrt{a^2+b^2} = \sqrt{1+1} = \sqrt{2}$, we get

$\frac{1}{\sqrt{2}}cosx + \frac{1}{\sqrt{2}}sinx = \frac{2}{\sqrt{2}}$

$\Rightarrow cos\left(\frac{\pi}{4}\right)cosx + sinxsin\left(\frac{\pi}{4}\right) = \sqrt{2}$

$\Rightarrow cos\left[\frac{\pi}{4} - x\right] = \sqrt{2} > 1$

$So\ \ no\ \ solution\ \ possible$

112. (c)

$(0, \pi)$

Explanation:

$(cosp–1)x^2 + (cosp)x + sinp = 0$

$We\ \ have\ \ the\ \ roots\ \ are\ \ real\ \ when\ \ the\ \ discriminant \geq 0$

$\Longrightarrow cos^2p - 4(cosp–1).sinp \geq 0$

$\Longrightarrow cos^2p - 4cospsinp + 4sinp \geq 0$

$\Longrightarrow (cosp–2sinp)^2 - 4sin^2p + 4sinp \geq 0$

$\Longrightarrow (cosp–2sinp)^2 + 4sinp(1 - sinp) \geq 0$.....$(i)$

$We\ \ have\ \ for\ \ all\ \ values\ \ of\ \ p\ \ \ (cosp–2sinp)^2 \geq 0\ \ \ and\ (1 - sinp) \geq 0 \qquad [\because sinp \leq 1]$

$Hence\ \ from\ \ \ equation\ \ (i)\ \ we\ \ get\ \ sinp\ \ has\ \ to\ \ be\ \ nonnegative\ \ for\ \ all\ \ values\ \ of\ \ p$

$But\ \ we\ \ have\ \ \ sinp \geq 0\ \ \ only\ \ when\ \ \ p \in (0, \pi)$

113. (a)

2

Explanation:

$Given \quad sin\theta + cosec\theta = 2$

$Squaring \quad on \quad both \quad sides, we \quad get$

$sin^2\theta + cosec^2\theta + 2sin\theta cosec\theta = 4 \qquad [\because \quad sin\theta cosec\theta = 1 \quad]$

$\Rightarrow sin^2\theta + cosec^2\theta = 4 - 2 = 2$

114. (c)

$c^2 - 3c - 7 = 0$

Explanation:

$Using \quad Cosine \quad Rule \quad we \quad have \quad cosA = \frac{b^2+c^2-a^2}{2bc}$

$\Rightarrow cos60^\circ = \frac{1}{2} = \frac{9+c^2-16}{6c}$

$\Rightarrow c^2 - 7 = 3c$

$\Rightarrow c^2 - 3c - 7 = 0$

$\Rightarrow c \quad is \quad the \quad root \quad of \quad the \quad equation \quad x^2 - 3x - 7 = 0$

115. (c)

$\sin(\alpha - \beta) = 0$

Explanation:

$Given \quad sin\alpha = sin\beta \quad and \quad cos\alpha = cos\beta$

$Now \quad sin\alpha . cos\beta = cos\alpha . sin\beta$

$\Rightarrow sin\alpha . cos\beta - cos\alpha . sin\beta = 0$

$\Rightarrow sin(\alpha - \beta) = 0$

116. (c)

$\frac{1}{2}$

Explanation:

$sin\theta cos\theta = \frac{1}{2}.2sin\theta cos\theta = \frac{1}{2}. sin2\theta$

$But \quad the \quad maximum \quad value \quad of sin2\theta \quad is 1.$

$So \quad the \quad maximum \quad value \quad of \quad sin\theta cos\theta = \frac{1}{2}$

117. (a)

8

Explanation:

When n =1 the value is 16 which is a multple of 8 , n = 2 the value is 88 which is a multiple of 8..... By PMI the expression is divisible by 8 for all natural numbers.

118. (b)

2304

Explanation:

When n = 1 the value is 0. When n = 2 the value is 2304..... Hence by the principle of mathematical induction the expression is divisible by 2304.

119. (d)

11

Explanation:

put n = 1 we get 11 .

120. (a)

$\frac{n}{3(2n+3)}$

Explanation:
By the process of mathematical induction when n = 1 we have $1/15$. When n = 2 we have LHS : $1/15 + 1/35 = 2/21$, RHS : $2/(3(4+3)) = 2/21$, which is true