# Atomic Energy Central School No. 4 Rawatbhata
## Class XII (Physics, Chemistry, Mathematics)
**Time:3 hours Multiple Choice Questions Examination Aug(2019-20) MM: 120**

**Name of student:_____________________Class:______ Roll No.____Invig Sign___**

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

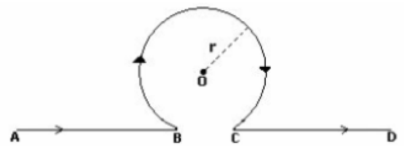
## Physics

1. A magnetic needle lying parallel to a magnetic field requires W units of work to turn it, through $60^0$. The torque needed to maintain the needle in this position will be **1**

   a) $\sqrt{(3W)}$ b) $\frac{(\sqrt{3}W)}{2}$

   c) 2 W d) W

2. An infinitely long straight conductor is bent into the shape as shown in fig. The magnetic induction at the centre of circular loop is **1**




   a) $\infty$ b) $\frac{\mu_o i}{2\pi r}(\pi - 1)$

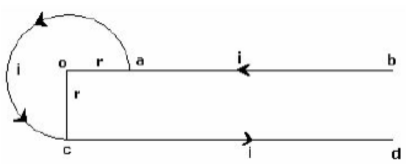
   c) $\frac{\mu_o i}{2\pi r}(\pi + 1)$ d) zero

3. If number of turns, area and current through a coil is given by n, A and i respectively then its magnetic moment will be **1**

   a) $n^2iA$ b) ni A

   c) $niA^2$ d) $ni\sqrt{A}$

4. What is magnetic induction at point O, if the current carrying wire is in the shape given in the figure? **1**




   a) $\frac{\mu_o i}{4\pi r}$ b) $\frac{\mu_o i}{4\pi r}.\frac{2\pi}{2}$

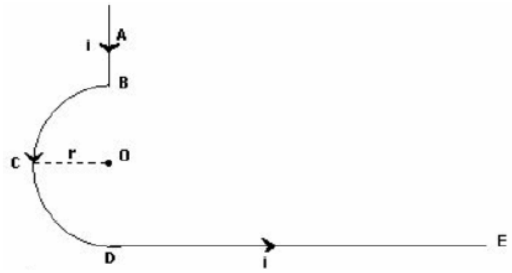
   c) $\frac{\mu_o i}{4\pi r}[\frac{3\pi}{2} + 1]$ d) $\frac{\mu_o i}{4\pi r}[\frac{\pi}{2} + 1]$

5. An electron is revolving around a proton in a circular orbit of diameter 0.1 nm. It produces a magnetic field of 14 $Wb/m^2$ at the proton. What is angular speed of the electron? **1**

   a) $4.4 \times 10^{16} rads^{-1}$ b) $8.8 \times 10^{16} rads^{-1}$

c) $6.4 \times 10^{16} \mathrm{rads}^{-1}$ d) $1.4 \times 10^{16} \mathrm{rads}^{-1}$

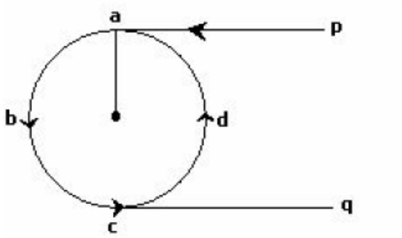
6. In the fig given below magnetic induction at the point O is **1**




a) $\frac{\mu_o I}{4r} \cdot \frac{\mu_o I}{4\pi r}$ b) $\frac{\mu_o I}{4r} + \frac{\mu_o I}{2\pi r}$

c) $\frac{\mu_o I}{4r} + \frac{\mu_o I}{4\pi r}$ d) $\frac{\mu_o I}{4\pi r}$

7. ABCD is a circular coil of non-insulated thin uniform conductor. Conductors pa and qc are very long straight parallel wires, tangential to the coil at points a and c. Find magnetic induction at centre of coil when a current of 5 A is passing thereby. Radius of coil is 10 cm **1**




a) $0.5 \times 10^{-5} \mathrm{T}$ b) $2 \times 10^{-5} \mathrm{T}$

c) $2.4 \times 10^{-5}\ T$ d) None of these

8. Two long parallel wires P and Q are held perpendicular to the plane of the paper with distance of 5 m between them. If P and Q carry current of 2.5 A and 5A respectively in the same direction, then the magnetic field at a point half way between the wire is: **1**

a) $\frac{\sqrt{3}\mu_0}{\pi}$ b) $\frac{\mu_0}{\pi}$

c) $\frac{3\mu_0}{2\pi}$ d) $\frac{\mu_0}{2\pi}$

9. In a coil of 0.1 m radius and 100 turns, 0.1 amp current is passed. What will be the magnetic field at the centre of the coil **1**

a) $6.28 \times 10^{-4}\ T$ b) $4.31 \times 10^{-2} \mathrm{T}$

c) $2 \times 10^{-1} \mathrm{T}$ d) $9.81 \times 10^{-4} \mathrm{T}$

10. A proton (charge + e coul) enters a magnetic field of strength B (Tesla) with speed v, parallel to the direction of magnetic lines of force. The force on the proton is **1**

a) evB/2 b) $\alpha$

c) zero d) evB

11. The magnetic field in a circular loop of diameter 0.1 m carrying a current of 1 A is **1**

a) $3.8 \times 10^{-5} T$ b) $4.4 \times 10^{-5} T$

c) $1.25 \times 10^{-8} T$ d) $2.8 \times 10^{-5} T$

12. A bar magnet is equivalent to **1**

a) toroid carrying current b) circular coil carrying current

c) solenoid carrying current d) straight conductor carrying current

13. A particle having charge 100 times that of an electron is revolving in a circular path of radius 0.8 m with one rotation per second. Magnetic field produced at the centre of the circular path is **1**

a) $10^{-17} \mu_o$ b) $10^{-7} \mu_o$

c) $10^{-3} \mu_o$ d) $10^{-11} \mu_o$

14. A wire of given length is first bent in one loop and then in three loops. If same current is passed in both cases, the ratio of magnetic inductions at the centre will be **1**

a) 1 : 4 b) 9 : 1

c) 1 : 9 d) 1 : 3

15. A wire of length L is bent to form a ring of single loop and current is flown through it. The magnetic field at its centre is B. If the same wire is bent to form 2 loops and same current is flowing, the new B' at its centre will be **1**

a) B b) $\frac{B}{2}$

c) 4B d) 2B

16. If electron velocity is $2\hat{i} + 3\hat{j}$ and it is subjected to magnetic field of $4\hat{k}$, then its **1**

a) none of these b) speed will change

c) both path will change and speed will change d) path will change

17. Two straight horizontal parallel wires are carrying the same current in the same direction, d is the distance between the wires. You are provided with a small freely suspended magnetic needle. At which of the following positions will the orientation of the needle be independent of the magnitude of the current in the wires **1**

a) at a distance $\frac{a}{2}$ from any of the wires in the horizontal plane

b) anywhere on the circumference of a vertical circle of a radius d and centre

c) at a distance $\frac{d}{2}$ from any of the wires

d) at points halfway between the wires in the horizontal plane.

18. A wire of length L carrying current i is placed perpendicular to the magnetic induction B. The total force on the wire is **1**

a) LB/i
b) iL/B
c) iLB
d) iB/L

19. The resistance of the coil of ammeter is R. The shunt resistance required to increase its range four fold should have a resistance: **1**

a) $\frac{R}{3}$
b) $\frac{R}{5}$
c) $\frac{R}{4}$
d) 4 R

20. The ratio of magnetic induction on the axis of a straight long current carrying solenoid at a point on end to that at the centre of solenoid is **1**

a) 1 : 1
b) $\sqrt{2}$ : 1
c) 2 : 1
d) 1 : 2

21. A bar magnet of magnetic moment M and length L is cut into two equal parts each of length $\frac{L}{2}$. The magnetic moment of each part will be: **1**

a) $\frac{M}{2}$
b) $\frac{M}{4}$
c) M
d) $\sqrt{2}M$

22. A magnetic needle is kept in a non-uniform magnetic field such that dipole moment is never parallel or antiparallel to magnetic field. It experiences: **1**

a) a force and a torque
b) a torque, but not a force
c) neither a force nor a torque
d) a force, but not a torque

23. A long solenoid with 60 turns of wire per centimeter carries a current of 0.15 A. The wire that makes up the solenoid is wrapped around a solid core of silicon steel $K_m$ = 5200 (The wire of the solenoid is jacketed with an insulator so that none of the current flows into the core.) For a point inside the core, find the magnitude of the total magnetic field **1**

a) 6.88T
b) 5.88T
c) 5.00T
d) 4.88T

24. A bar magnet of magnetic moment 1.5 J/T lies aligned with the direction of a **1**

uniform magnetic field of 0.22 T. What is the amount of work required by an external torque to turn the magnet so as to align its magnetic moment normal to the field direction?

a) 0.43J | b) 0.33J
c) 0.23J | d) 0.38J

25. A bar magnet of magnetic moment 1.5 J/T lies aligned with the direction of a uniform magnetic field of 0.22 T. What is the amount of work required by an external torque to turn the magnet so as to align its magnetic moment opposite to the field direction? **1**

a) 0.66J | b) 0.86J
c) 0.56J | d) 0.76J nC

26. The radius of the coil of a Tangent Galvanometer which has 10 turns is 0.1 m. The current required to produce a deflection of 60°, $\left(B_H = 4 \times 10^{-5} T\right)$ is: **1**

a) A | b) 2.6 A
c) 2.1 A | d) 1.1 A

27. A current is flowing north along a power line. The direction of the magnetic field above it neglecting the earth's field is towards. **1**

a) south | b) west
c) north | d) east

28. A Rowland ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. What is the magnetic field B in the core for a magnetising current of 1.2A? **1**

a) 3.48 T | b) 5.48 T
c) 4.08 T | d) 4.48 T

29. A toroidal solenoid with 500 turns is wound on a ring with a mean radius of 2.90 cm. Find the current in the winding that is required to set up a magnetic field of 0.350 T in the ring if the ring is made of silicon steel of relative permeability,$\mu_r = 5200$ **1**

a) 19.5mA | b) 21.5mA
c) 23.5mA | d) 22.5mA

30. A short bar magnet has a magnetic moment of 0.48 J/T .Magnetic field produced by the magnet at a distance of 10 cm from the centre of the magnet on the axis has a direction and magnitude of . **1**

a) 0.76 G along S-N direction. | b) 0.86 G along S-N direction.

c) 1.06 G along S-N direction. d) 0.96 G along S-N direction.

31. A long solenoid with 60 turns of wire per centimeter carries a current of 0.15 A. The wire that makes up the solenoid is wrapped around a solid core of silicon steel $K_m$ = 5200 (The wire of the solenoid is jacketed with an insulator so that none of the current flows into the core.) the magnetization inside the core is **1**

a) 4.48MA/m b) 4.88MA/m

c) 4.68MA/m d) 4.28MA/m

32. A short bar magnet placed in a horizontal plane has its axis aligned along the magnetic north-south direction. Null points are found on the axis of the magnet at 14 cm from the centre of the magnet. The earth's magnetic field at the place is 0.36 G and the angle of dip is zero. What is the total magnetic field on the normal bisector of the magnet at the same distance as the null–point (i.e., 14 cm) from the centre of the magnet? (At null points, field due to a magnet is equal and opposite to the horizontal component of earth's magnetic field.) **1**

a) 0.62 G in the direction of earth's field. b) 0.54 G in the direction of earth's field.

c) 0.58 G in the direction of earth's field. d) 0.64 G in the direction of earth's field.

33. A sample of paramagnetic salt contains $2.0 \times 10^{24}$ atomic dipoles each of dipole moment $1.5 \times 10^{-23} JT^{-1}$. The sample is placed under a homogeneous magnetic field of 0.64 T, and cooled to a temperature of 4.2 K. The degree of magnetic saturation achieved is equal to $15\%$. What is the total dipole moment of the sample for a magnetic field of 0.98 T and a temperature of 2.8 K? (Assume Curie's law) **1**

a) 8.2 J/T b) 10.34 J/T

c) 5.9 J/T d) 6.6 J/T

34. Magnetic dipole moment is a vector quantity directed from: **1**

a) east to west b) south to north

c) west to east d) north to south

35. A magnet of magnetic moment M is kept in a uniform magnetic field of strength B, making an angle $\theta$ with its direction. The torque acting on it is: **1**

a) $MB(1 - \cos\theta)$ b) MB

c) $MB \sin\theta$ d) $MB \cos\theta$

36. A circular coil of 16 turns and radius 10 cm carrying a current of 0.75 A rests with its plane normal to an external field of magnitude $5.0 \times 10^{-2}$ T. The coil is free to turn about an axis in its plane perpendicular to the field direction. When the coil is turned slightly and released, it oscillates about its stable equilibrium with a frequency of 2.0 $s^{-1}$. What is the moment of inertia of the coil about its axis of rotation **1**

a) $1.2 \times 10^{-4} \mathrm{kgm}^2$ b) $2.0 \times 10^{-4} \mathrm{kgm}^2$

c) $2.2 \times 10^{-4} \mathrm{kgm}^2$ d) $1.4 \times 10^{-4} \mathrm{kgm}^2$

37. A magnetic dipole is under the influence of two magnetic fields. The angle between the field directions is $60^0$, and one of the fields has a magnitude of $1.2 \times 10^{-2}$ T. If the dipole comes to stable equilibrium at an angle of $15^0$ with this field, what is the magnitude of the other field? **1**

a) $5.6 \times 10^{-3}$ T b) $4.8 \times 10^{-3}$ T

c) $5.2 \times 10^{-3}$ T d) $4.4 \times 10^{-3}$ T

38. At a given place on the earth's surface, horizontal component of earth's magnetic field is $3 \times 10^{-5} T$ and resultant magnetic field is $6 \times 10^{-5} T$ . The angle of dip at the place is: **1**

a) 40° b) 30°

c) 60° d) 50°

39. The force between two magnetic poles is F. If the distance between the poles and pole strengths of each pole are doubled, then the force experienced is: **1**

a) F b) $\frac{F}{4}$

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

40. A toroidal solenoid with 500 turns is wound on a ring with a mean radius of 2.90 cm. Find the current in the winding that is required to set up a magnetic field of 0.350 T in the ring if the ring is made of annealed iron of relative permeability, $\mu_r = 1400$ **1**

a) 72.5mA b) 69.5mA

c) 79.5mA d) 82.5mA

## Chemistry

41. Which of the following turns lead acetate paper black? **1**

a) $H_2S$ b) $H_2SO_4$

c) $SO_2$ d) $SO_3$

42. When chlorine is passed through concentrated hot solution of KOH, the compound formed is **1**

a) $KClO_2$ b) KClO

c) $KClO_4$ d) $KClO_3$

43. How many moles of oxygen are obtained by heating 8 mol of potassium chlorate? **1**

a) 28 b) 8

c) 16 d) 12

44. Which of the following is thermally the most stable? **1**

a) $H_2O$ b) $H_2Se$

c) $H_2S$ d) $H_2Te$

45. Laughing gas is **1**

a) $N_2O_3$ b) $N_2O_5$

c) $N_2O$ d) NO

46. First compound of inert gas was prepared by Bartlett in 1962. The compound is **1**

a) $XeOF_4$ b) $XeO_3$

c) $XeF_6$ d) $Xe[PtF_6]$

47. Which of the following reaction depicts the oxidizing behaviour of H SO ? **1**

a) $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$

b) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

c) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

d) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$

48. When sugar is treated with conc. Sulphuric acid, the sugar is charred. In this process, sugar is **1**

a) Oxidised b) Reduced

c) Dehydrated d) Sulphonated

49. The structure of ClF is **1**

a) Octahedral
b) T-shaped
c) Pyramidal
d) Tetrahedral

50. In XeO and XeF the oxidation state of Xe is **1**

a) +4
b) +6
c) +3
d) +1

51. Pure chlorine is obtained **1**

a) By heating $PtCl_4$
b) By treating bleaching powder with HCl
c) By heating $MnO_2$ and HCl
d) By heating a mixture of NaCl and $MnO_2$ with conc. Sulphuric acid

52. When KBr is treated with conc. H SO , reddish brown gas is evolved. The gas is **1**

a) $Br_2$ + HBr
b) $NO_2$
c) $H_2O_2$
d) $Br_2$

53. A radioactive element which can decay to give two noble gases is **1**

a) $Ac^{239}$
b) $U^{238}$
c) $Ra^{226}$
d) $Th^{232}$

54. Fluorine reacts with conc. NaOH to produce **1**

a) NaF and $O_2$
b) NaF and $O_2F$
c) NaF and $OF_2$
d) NaF and $O_3$

55. Xenon difluoride has _____ shape. **1**

a) Linear
b) Trigonal
c) Angular
d) Pyramidal

56. Ni in traces can be tested using **1**

a) Dimethylglyoxime
b) Potassium ferrocyanide
c) Ammonium sulphocyanide
d) Sodium nitroprusside

57. The yellow colour of the chromate changes to orange on acidification due to the formation of **1**

a) $Cr_2O_7^{2-}$
b) $Cr_2O_3$
c) $CrO_2$
d) $CrO_4^{2-}$

58. Which is called chromic acid? **1**

a) CrO
b) $H_2CrO_4$
c) $Cr_3O_4$
d) $Cr_2O_3$

59. The lanthanoid contraction is due to : **1**

a) filling of 5d before 4f
b) filling of 4f before 4d
c) filling of 4d before 4f
d) filling of 4f before 5d

60. Which among the following is a synthetic element? **1**

a) Pa
b) U
c) Fm
d) Th

61. In the reaction, $SnCl_2 + HgCl_2 \rightarrow A + SnCl_4$ , A is **1**

a) $HgCl_2$
b) Hg
c) HgCl
d) $HgCl_3$

62. In dilute alkaline solution, MnO  changes to **1**

a) $MnO_4^{2-}$
b) $MnO_2$
c) $Mn_2O_3$
d) MnO

63. Oxidation state of Mn in $MnO_4^-$ is +7 indicating all electrons paired in Mn but $MnO_4^-$ is coloured. This is due to: **1**

a) none of these
b) both presence of unpaired electron in d-orbital in oxygen and charge transfer
c) presence of unpaired electron in d-orbital in oxygen
d) charge transfer

64. Which of the following is paramagnetic as well as coloured ion? **1**

a) $Ti^{4++}$
b) $Cu^+$
c) $Sc^{3+}$
d) $Cu^{2+}$

65. KMnO  is the oxo salt of **1**

a) $Mn_2O_3$
b) $MnO_3$
c) $Mn_2O_7$
d) $MnO_2$

66. Which of the following is not considered a transition metal? **1**

a) Zn
b) Ac
c) Y
d) La

67. Which one of the following element is the main metallic constituent of haemoglobin? **1**

a) Mn b) Fe

c) Cu d) Al

68. Among the following, which bivalent ion of the first transition series shows maximum magnetic moment ? **1**

a) $Co^{2+}$ b) $Ni^{2+}$

c) $Mn^{2+}$ d) $Fe^{2+}$

69. Sodium pentacyanonitrosylferrate(II) is also called **1**

a) Sodium ferrocyanide b) Sodium sulphocyanide

c) Sodium nitroprusside d) Sodium cobaltnitrite

70. Which of the following complex ions/molecules of nickel is paramagnetic? **1**

a) $[Ni(CO)_4]$ b) $[Ni(CN)_4]^{2-}$

c) $[Ni(NH_3)_4]^{2+}$ d) $Ni(dimethylglyoxime)_2$

71. A complex of platinum, ammonia and chlorine produces four ions per molecule in the solution. The structure consistent with the observation is **1**

a) $[Pt(NH_3)_2Cl_4]$ b) $[Pt(NH_3)_5Cl]Cl_3$

c) $[Pt(NH_3)_4Cl_2]Cl_2$ d) $[Pt(NH_3)_6]Cl_4$

72. K [Al(C O ) ] is called **1**

a) Potassium trioxalatoaluminate(III) b) Potassium alumina(III)oxalate

c) Potassium aluminooxalate

d) Potassium trioxalatoaluminum(III)

73. The formula of Zeise's salt is **1**

a) $K^+[PtCl_3(C_2H_4)]^-$ b) $[PtCl_3.C_2H_6]^-K^+$

c) $[PtCl_2.(C_2H_2)]^-K^+$ d) $[PtCl_3.C_6H_6]^-K^+$

74. Which is used in cancer therapy? **1**

a) Zeise's salt b) Cis – Platin

c) EDTA d) Cyanocobalamine

75. Which of the following compound would exhibit coordination isomerism? **1**

a) $[Cr(H_2O)]Cl_3$

b) $[Cr(NH_3)_6][Co(CN)_6]$

c) $[Cr(en)2]NO_2$

d) $[Ni(NH_3)_6][BF_4]_2$

76. The isomers [(C H ) P Pd(SCN) ] and [(C H ) P Pd(NCS) ] show **1**

a) Linkage isomerism

b) Coordination isomerism

c) Geometrical isomerism

d) Ionization isomerism

77. K CoF is high spin complex. What is the hybrid state of Co atom in this complex? **1**

a) $d^2sp^3$

b) $dsp^2$

c) $sp^3d$

d) $sp^3d^2$

78. The metal-carbon bond in metal carbonyls possess **1**

a) σ character

b) $\pi$ character

c) single bond

d) both σ and π character.

79. The hardness of water is estimated by **1**

a) Titration with EDTA

b) Gravimetric method

c) Distillation method

d) Conductivity method

80. Which of the following species is expected to be colourless? **1**

a) $[Ti(H_2O)_6]^{3+}$

b) $[Fe(CN)_6]^{4-}$

c) $[Cr(NH_3)_6]^{3+}$

d) $[Ti(NO_3)_4]$

## Mathematics

81. Derivative of sin x w.r.t cos x is **1**

a) cot x

b) – tan x

c) $\tan^3 x$

d) tan x

82. $\frac{d}{dx}\left(\tan^{-1}(\sec x+\tan x)\right)$ is equal to **1**

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

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

c) $\frac{1}{2\sec x(\sec x+\tan x)}$

d) None of these

83. If $y=\tan^{-1}$x and $z=\cot^{-1}x$ then $\frac{dy}{dz}$ is equal to **1**

a) 1

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

c) – 1

d) None of these

84. Derivative of cos(sin x) w.r.t. sin x is **1**

a) – sin(sin x)cosx

b) $\sec^2\left(\frac{x}{\sqrt{x^2+1}}\right)$

c) – sin(sin x)

d) None of these

85. If y = ax + b, then $\frac{d^2y}{dx^2}$ is equal to **1**

a) None of these
b) $\frac{ab}{y^2}$
c) $\frac{ab}{y^3}$
d) $\frac{ab}{x^3}$

86. If f(x) be any function which assumes only positive values and f'(x) exists then, f'(x) is equal to **1**

a) $f(x)\frac{d}{dx}\{e^{\log}(f(x))\}$
b) $f(x)\frac{d}{dx}\left(e^{f(x)}\right)$
c) $f(x)\frac{d}{dx}\{\log(f(x))\}$
d) None of these

87. Let f(x) = $\begin{cases} e^{1/x}, x<0 \\ x, x \geqslant 0 \end{cases}$, then $\underset{x\to 0}{Lt}\ f(x)$ **1**

a) does not exist
b) is equal to 0
c) is equal to non – zero real number
d) None of these

88. The derivate of an odd function is **1**

a) an odd function
b) an even function
c) None of these
d) negative

89. $\frac{d}{dx}(\cos^{-1}x) = -\frac{1}{\sqrt{1-x^2}}$ where **1**

a) $-1 \leqslant x \leqslant 1$
b) -1 < x < 1
c) $-1 \leqslant x < 1$
d) $-1 < x \leqslant 1$

90. Let f(x) = x – [x], then f ' (x) = 1 for **1**

a) all $x \in \mathbf{I}$
b) all $x \in \mathbf{R}$
c) all $x \in \mathbf{R}$ – {0]
d) all $x \in (\mathbf{R} - \mathbf{I})$

91. If x sin (a + y) = sin y, then $\frac{dy}{dx}$ is equal to **1**

a) $\frac{\sin a}{\sin(a+y)}$
b) $\frac{\sin^2(a+y)}{\sin a}$
c) $\frac{\sin a}{\sin^2(a+y)}$
d) $\frac{\sin(a+y)}{\sin a}$

92. $\frac{d}{dx}\left(\log\left|\tan\frac{x}{2}\right|\right)$is equal to **1**

a) $\frac{2}{\sin x}$
b) None of these
c) $\frac{1}{\tan\frac{x}{2}}$
d) cosec x

93. If f(x) = $x\left(\sqrt{x}-\sqrt{x+1}\right)$, then **1**

a) f (x) is not differentiable at x = 0
b) f (x) is continuous but not differentiable at x = 0
c) f(x) is differentiable at x = 0
d) None of these

94. $\underset{x\to 0}{Lt}\ \frac{x(e^{\sin x}-1)}{1-\cos x}$ is equal to **1**

a) 2 b) 1

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

95. If f (x) = x tan x then f ' (1 ) is equal to **1**

a) None of these b) $\frac{1}{2} - \frac{\pi}{4}$

c) $\frac{\pi}{4} - \frac{1}{2}$ d) $\frac{\pi}{4} + \frac{1}{2}$

96. If x = acos t, y = asin t, then $\frac{dy}{dx}$ is equal to **1**

a) – tan t b) cosec t

c) cos t d) cot t

97. If f (x) = tan x and g (x) = tan $^{1}\left(\frac{x+1}{1-x}\right)$, then **1**

a) f ' (x) = g ' (x) b) f (x) = g(x)

c) None of these d) $D_f = D_g$

98. $\frac{d^4}{dx^4}(\sin^3 x)$ is equal to **1**

a) $\frac{3}{4}\cos x - \frac{3^4 \cos 3x}{4}$ b) None of these

c) $\frac{3 \sin x - 3^4 \sin 3x}{4}$ d) $\frac{3}{4}\sin x - \frac{3^4 \cos 3x}{4}$

99. $\frac{d}{dx}(\log|x|)$is equal to $(x \neq 0)$ **1**

a) $\pm\frac{1}{x}$ b) $\frac{1}{x}$ or $-\frac{1}{x}$

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

100. Let f be a function satisfying f(x + y) = f(x) + f(y) for all x, y$\in$ $\mathbf{R}$, then f ' (x) = **1**

a) f (0) for all $x \in \mathbf{R}$ b) None of these

c) 0 for all $x \in \mathbf{R}$ d) f ' (0) for all $x \in \mathbf{R}$

101. The equation of the normal to the curve y = sinx at (0, 0) is **1**

a) x – y = 0 b) x = 0

c) x + y = 0 d) y = 0

102. The function f (x) = x has a stationary point at **1**

a) x = 1 b) $x = \sqrt{e}$

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

103. Tangents to the curve y= x + 3x at x = -1 and x = 1 are **1**

a) intersecting at right angles b) intersecting at an angle of $45^o$.

c) intersecting obliquely but not at an angle of $45^o$ d) parallel

104. Tangents to the curve x + y = 2 at the points (1, 1) and ( – 1, 1) **1**

a) at right angles b) intersecting but not at right angles

c) none of these d) parallel

105. Let f (x) =x , then f (x) has a **1**

a) point of inflexion at x = 0 b) local maxima at x = 0

c) none of these d) local minima at x = 0

106. The curve y = $a\ x^3 + bx^2 + c\ x$ is inclined at $45°$ to the X – axis at (0, 0) but it touches X – axis at (1, 0) , then the values of a, b, c, are given by **1**

a) a = 1, b = – 2, c = 1 b) a = 1, b = 1, c = – 2

c) a = – 2, b = 1, c = 1 d) a = – 1, b = 2, c = 1.

107. The function f (x) = x - 3x has a **1**

a) local minima at x = 1 b) local maxima at x = 1

c) point of inflexion at 0 d) none of these

108. The function f(x) = |x| has **1**

a) only one maxima b) only one minima

c) no maxima or minima d) none of these

109. The function f (x) = $x + \frac{4}{x}$ has **1**

a) a local maxima at x =2 and a local minima at x = – 2

b) local minima at x = 2 and a local maxima at x = – 2

c) No maximum and minimum

d) absolute maxima at x = 2 and absolute minima at x = – 2

110. Minimum value of the function f(x) = x + x + 1 is **1**

a) none of these b) 3

c) $\frac{3}{4}$ d) 1

111. Find the approximate value of f(5.001) where $f(x) = x^3 - 7x^2 + 15$ **1**

a) -33.995 b) -34.995

c) None of these d) $-35.005$

112. Find the slope of the normal to the curve $x = acos^3\theta, y = asin^3\theta$ at $\theta = \frac{\pi}{4}$ **1**

a) none of these b) -1

c) 1 d) 0

113. The minimum value of $\frac{x}{\log x}, x > 1$, is **1**

a) none of these b) e

c) – e d) $\frac{1}{e}$

114. If f (x) = $x + \frac{1}{x}$, then **1**

a) relative maximum does not exist

b) relative maximum > relative minimum

c) relative minimum does not exist

d) relative minimum > relative maximum

115. Let f (x) be differentiable in (0, 4) and f (2) = f (3) and S = {c : 2 < c < 3, f' (c) = 0 } then 1

a) none of these b) S = { }

c) S has exactly one point d) S has atleast one point

116. Equation of the tangent to the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ at the point (a, b) is **1**

a) none of these
b) $\frac{x}{a} + \frac{y}{b} = 0$
c) $\frac{x}{a} + \frac{y}{b} = 1$
d) $\frac{x}{a} + \frac{y}{b} = 2$

117. Given that f (x) = $x^{1/x}$ , x > 0 has the maximum value at x = e,then **1**

a) $e^{\pi} = \pi^{e}$
b) $e^{\pi} \leqslant \pi^{e}$
c) $e^{\pi} > \pi^{e}$
d) $e^{\pi} < \pi^{e}$

118. For a real number x, let [x] denote the greatest integer less than or equal to x **1**
and f (x) = $\frac{\tan(\pi[x-\pi])}{1+[x]^2}$,then

a) f '(x) exists for all x but f ''(x) does not exist
b) f '(x) exists for all x
c) continuous for some x
d) continuous at all x but f '(x) does not exist

119. The curve y = $x^{1/5}$ has at (0, 0) **1**

a) a vertical tangent
b) oblique tangent
c) a horizontal tangent
d) no tangent

120. The equation of the tangent to the curve y = 4ax at the point (at , 2at) is **1**

a) ty = x +$at^2$
b) none of these
c) tx + y =a $t^3$
d) ty = x – $at^2$

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**Solution**

**Class 12 - Physics**

**MCQ (2019-20)**

**Section A**

1. (a)
   $\sqrt{(3W)}$

   Explanation:
   the work done to turn a needle through an angle θ is $W = mB\cos\theta$
   The torque needed to maintain $\tau = mB\sin\theta$.
   $\frac{\tau}{W} = \tan\theta$.
   $\tau = W\tan\theta = W\tan 60 = \sqrt{3}W$
2. (b)
   $\frac{\mu_o i}{2\pi r}(\pi - 1)$

   Explanation:
   Magnetic field directions due to straight conductor and due to circular loop are in the opposite direction
   net magnetic field is
   = $\frac{\mu_o i}{2\pi r}(\pi - 1)$
3. (b)
   ni A

   Explanation:
   The magnetic moment associated with a coil carrying current is given by the product of its area and the current through it. M=n I A
4. (c)
   $\frac{\mu_o i}{4\pi r}\left[\frac{3\pi}{2} + 1\right]$

   Explanation:
   Magnetic field due to ba straight conductor is zero. Magnetic field due to circular current carrying conductor ac is $\frac{3}{4}\frac{\mu_0 I}{2r}$ (outward) and magnetic field due to straight conductor cd is $\frac{\mu_0}{4\pi} \times \frac{I}{r}$ (outward)

Total magnetic field is $\frac{\mu_o i}{4\pi r}[\frac{3\pi}{2}+1]$

5. (a)

$4.4 \times 10^{16} \text{rads}^{-1}$

Explanation:

The revolving electron is similar to a loop carrying current. Field at the center of the loop of radius r is $B = \frac{\mu_0 I}{2r}$.

The current due to the revolving electron $I = \frac{B(2r)}{\mu_0} = \frac{14\times0.1\times10^{-9}}{4\pi\times10^{-7}} = \frac{7\times10^{-3}}{2\pi}$

The current can also be written as, $I = \frac{e}{T}$

where, T is the time taken to complete one revolution. Since $T = \frac{2\pi}{\omega}$

where $\omega$ is the angular speed of the electron, $I = \frac{e}{T} = \frac{e\omega}{2\pi}$

$\frac{e\omega}{2\pi} = \frac{7\times10^{-3}}{2\pi}$

$\omega = \frac{7\times10^{-3}}{e} = \frac{7\times10^{-3}}{1.6\times10^{-19}}$

$= 4.38 \times 10^{16} \approx 4.4 \times 10^{16} rad/s$

6. (c)

$\frac{\mu_o I}{4r} + \frac{\mu_o I}{4\pi r}$

Explanation:

Magnetic field due to AB conductor is 0, magnetic field due to semicircular arc BCD and straight conductor DE are in the same direction so add up

net magnetic field = $\frac{\mu_o I}{4r} + \frac{\mu_o I}{4\pi r}$

7. (c)

$2.4 \times 10^{-5}\ T$

Explanation:

Magnetic field due to pa,abcd and cq are acting along the same direction so total field is the sum due to field of all the conductors

= $\frac{\mu_0}{4\pi} \times \frac{I}{r} + \frac{\mu_0}{2} \times \frac{I}{r} + \frac{\mu_0}{4\pi} \times \frac{I}{r}$

= $2.4 \times 10^{-5}\ T$

8. (d)

$\frac{\mu_0}{2\pi}$

Explanation:

Net magnetic field = $\frac{\mu_0}{4\pi} \times \frac{2}{\mathrm{r}} \times (\mathrm{I}_2 - \mathrm{I}_1)$

r = 2.5 m; $\mathrm{I}_1 = 2.5\ \mathrm{A};\ \mathrm{I}_2 = 5\ \mathrm{A}$

net magnetic field $= \frac{\mu_0}{2\pi}$

9. (a)

$6.28 \times 10^{-4}\ T$

Explanation:

$B = \frac{\mu_0 n I}{2r}$

$= \frac{4\pi \times 10^{-7} \times 100 \times 0.1}{2 \times 0.1}$

$= 6.28 \times 10^{-4}$

10. (c)

zero

Explanation:

Lorentz force is given by $F = Bqv \sin\theta$

When the proton enters the magnetic field parallel to the direction of the lines of force, $\theta = 0$.

Therefore F = 0

11. (c)

$1.25 \times 10^{-8} T$

Explanation:

$B = \frac{\mu_0 I}{2r} = \frac{4\pi \times 10^{-7} \times 1}{0.1}$

$= 12.56 \times 10^{-6}$

$= 1.25 \times 10^{-5} T$

12. (c) solenoid carrying current

Explanation:

A solenoid carrying current produces a magnetic field very similar to that of bar magnet. The magnetic field lines emerge from the ends of a solenoid and the number of field lines near its perpendicular bisector is almost equal to zero. A circular coil produces field along its axis. A straight conductor produces a magnetic field that can be represented by concentric circles. A toroid is a solenoid that has collapsed on itself. The field in a toroid is confined to the ring like region bounded by the toroid.

13. (a)

$10^{-17}\,\mu_o$

Explanation:

A charge moving in a circular path is equivalent to a current $I = \frac{q}{T}$

Since the particle has charge 100 times e and it makes 1 revolution per second,

q = 100e and T = 1s.

$I = \frac{q}{T} = \frac{100e}{1}$

$= 100 \times 1.6 \times 10^{-19}$

$= 1.6 \times 10^{-17} A$

The magnetic field at the centre $B = \frac{\mu_0 I}{2r} = \frac{\mu_0 \left(1.6 \times 10^{-17}\right)}{2 \times 0.8} = \mu_0 \times 10^{-17}$

14. (c)

1 : 9

Explanation:

$L = 2\pi\mathrm{r} \;= 3 \times 2\pi\mathrm{r}$

$\frac{\mathrm{B}}{\mathrm{B}} = \frac{\mathrm{r}}{3\mathrm{r}} = \frac{1}{9}$

1 : 9

15. (c)

4B

Explanation:

The radii of the coils in two cases are $R_1$ and $R_2$.

Then, $L = 2\pi R_1 = 2 \times 2\pi R_2; R_2 = \frac{R_1}{2}$

$B = \frac{\mu_0 I}{2R_1}$ and $B' = \frac{\mu_0 nI}{2R_2} = \frac{\mu_0 2I}{2\left(\frac{R_1}{2}\right)} = 4\frac{\mu_0 I}{2R_1} = 4B$

16. (d)

path will change

Explanation:

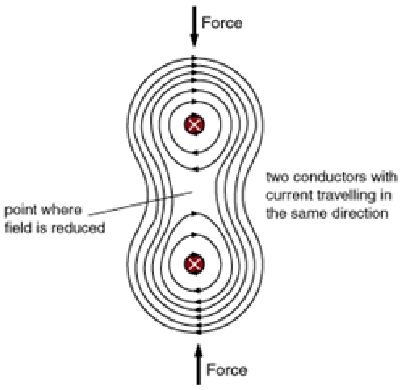
As magnetic force always act perpedicular to the direction of motion so path or direction will change withot any change in speed.

17. (d)

at points halfway between the wires in the horizontal plane.

Explanation:

Consider two wires carrying current in the same direction as shown. The current acts inwards to the plane of the screen. The magnetic field lines are in the plane of the screen and are concentric circles. At the point midway between the wires, the field lines are directed opposite to each other. The magnetic fields due to




the two wires are directed opposite to each other. They also have the same magnitude since the wires carry currents of equal magnitude. At a distance $\frac{d}{2}$, in the horizontal plane, the net magnetic field is zero. A magnetic needle placed at this point experiences no force. The orientation of the needle becomes independent of the current in the wires.

18. (c) iLB

Explanation:

Magnitude of the Force experienced by a current carrying conductor placed in a magnetic field is $ILB\sin\theta$. If the angle between the directions of the current and the magnetic field is $90^o$, F= iLB

19. (a)

$\frac{R}{3}$

Explanation:

voltage across ammetre and shunt are same. so

$V = I \times R = 3I \times S$

solving S= R/3

20. (c)

2 : 1

Explanation:

A solenoid is equivalent to a bar magnet.

For points at distances greater than the length of the solenoid, the field along the axis of the solenoid is $B_{axial} = \frac{\mu_0}{4\pi}\frac{2m}{x^3}$ and along the perpendicular bisector or equatorial line is $B_{equatorial} = \frac{\mu_0}{4\pi}\frac{m}{x^3}$

$\frac{B_{axial}}{B_{equatorial}} = \frac{2}{1}$

21. (a)

$\frac{M}{2}$

Explanation:

Since magnetic moment is given by product of pole strength and length of dipole, when it is cut into two pieces of half the length, each peice will have magnetic moment equal to half of the original piece.

22. (a)

a force and a torque

Explanation:

In non uniform magnetic field, force on both the poles is opposite but not equal hence it experiences force.

And as angle between directions of magnetic moment and magnetic field is neither 0 or nor 180$^{0}$, hence it also experiences torque.

23. (b)

5.88T

Explanation:

$B = \mu_o K_m n i$

$= 4\pi \times 10^{-7} \times 5200 \times 60 \times 10^2 \times 0.15$

= 5.88T

24. (b)

0.33J

Explanation:

Work done,

$W = mB[cos\theta_1 - cos\theta_2]$

$= 1.5 \times 0.22 \times \left[cos\theta - cos\frac{\pi}{2}\right]$
$= 1.5 \times 0.22 = 0.33J$

25. (a)

0.66J

Explanation:
$W = mB[cos\theta_1 - cos\theta_2] = mB[cos0 - cos\pi]$
$= 2mB = 2 \times 1.5 \times 0.22 = 0.66J$

26. (d)

1.1 A

Explanation:
When no current is passed through the coil, the magnetic needle is influenced only by $B_H$. When current I is passed, there is a magnetic field B along the axis of the coil, perpendicular to $B_H$. The magnetic needle comes to rest at an angle with $B_H$, such that,
$B = B_H \tan\theta$
Also B at centre of coil is equal to $\mu_o NI/2R$
Hence $I = \frac{2RB_H tan\theta}{\mu_o N} = \frac{2\times0.1\times4\times10^{-5}\times\sqrt{3}}{4\pi\times10^{-7}\times10} = 1.1A$

27. (d) east
Explanation:
According to Right Hand Rule (If one points thumb of his right hand in the direction of current, then the direction in which the fingure curls gives the direction of magnetic field at that point. Hence the direction of magnetic field above the wire is east.

28. (d)

4.48 T

Explanation:
$B = \frac{\mu_o\mu_r Ni}{2\pi r} = \frac{4\pi\times10^{-7}\times800\times3500\times1.2}{2\pi\times15\times10^{-2}}$ = 4.48 T

29. (a)

19.5mA

Explanation:

$i=\frac{B\times2\pi r}{\mu_o\mu_r N}=\frac{0.35\times0.29\times10^{-2}}{4\pi\times10^{-7}\times5200\times500}$

$=19.5\times10^{-3}A$

30. (d)

0.96 G along S-N direction.

Explanation:

$\overrightarrow{B}_{axial}=\frac{\mu_o}{4\pi}\frac{2\overrightarrow{m}}{r^3}$

$=10^{-7}\times\frac{2\times0.48}{10^{-3}}T=0.96G$

Direction of magnetic field at axial point is along direction of magnetic moment i.e. from South to North.

31. (c)

4.68MA/m

Explanation:

$M=\frac{B}{\mu_o}=\frac{\mu_o K_M Ni}{\mu_o}$

$=5200\times60\times10^2\times0.15$

$=4.68\times10^6 A/m$

32. (b)

0.54 G in the direction of earth’s field.

Explanation:

Earth’s magnetic field at the given place,$H$ = 0.36 G

The magnetic field at a distance *d*, on the axis of the magnet is given as:

$B_1=\frac{\mu_0 M}{4\pi\times d^3}=H$ ...(i)

Where,

$\mu_0$ = Permeability of free space

$M$ = Magnetic moment

The magnetic field at the same distance *d*, on the equatorial line of the magnet is given as:

$B_2=\frac{\mu_0 M}{4\pi\times d^3}=\frac{H}{2}$ [Using equation (i)]

Total magnetic field, B = $B_1$ + $B_2$

$= H + \frac{H}{2}$

= 0.36 + 0.18 = 0.54G

Hence, the magnetic field is 0.54 G in the direction of earth's magnetic field.

33. (b)

10.34 J/T

Explanation:

Number of atomic dipoles, $n = 2.0 \times 10^{24}$

Dipole moment of each atomic dipole, $M = 1.5 \times 10^{-23} JT^{-1}$

When the magnetic field, $B_1$ = 0.64 T

The sample is cooled to a temperature, $T_1$ = 4.2°K

Total dipole moment of the atomic dipole, $M_{tot} = n \times M$

$= 2 \times 10^{24} \times 1.5 \times 10^{-23}$

= $30JT^{-1}$

Magnetic saturation is achieved at 15%.

Hence, effective dipole moment, $M_1 = \frac{15}{100} \times 30 = 4.5JT^{-1}$

When the magnetic field, $B_2$ = 0.98 T

Temperature, $T_2$ = 2.8°K

Its total dipole moment = $M_2$

According to Curie's law, we have the ratio of two magnetic dipoles as:

$\frac{M_2}{M_1} = \frac{B_2}{B_1} \times \frac{T_1}{T_2}$

$\therefore\ M_2 = \frac{B_2 T_1 M_1}{B_1 T_2}$

$= \frac{0.98 \times 4.2 \times 4.5}{2.8 \times 0.64} = 10.336JT^{-1}$

Therefore, $10.336JT^{-1} \approx 10.34JT^{-1}$ is the total dipole moment of the sample for a magnetic field of 0.98 T and a temperature of 2.8 K.

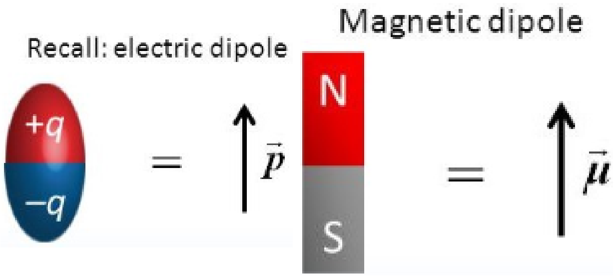
34. (b)

south to north

Explanation:

**Magnetic dipole & dipole moment**

A magnetic N and S pole make up a magnetic dipole




Magnetic dipole moment is analogous to an electric dipole moment.

Direction Vector from S to N pole (by convention).

35. (c)

$MB \sin\theta$

Explanation:

Torque is cross product of magnetic moment and magnetic field. Therefore, magnitude of torque is given by

$MB \sin\theta$

36. (a)

$1.2 \times 10^{-4} \mathrm{kgm}^2$

Explanation:

Here N = 16, r = 10 cm = 0.1 m, i = 0.75 A, B = 5 × $10^{-2}$T, $\nu = 2\ s^{-1}$

$m = NiA = Ni\pi r^2 = \frac{16\times0.75\times22}{7\times0.1^2} = .377J/T$

Moment of inertia, $I = \frac{mB}{4\pi^2\nu^2} = \frac{.377\times5\times10^{-2}}{4\times(3.14)^2\times2^2}$

$= 1.2 \times 10^{-4} kgm^2$

37. (d)

$4.4 \times 10^{-3}\mathrm{T}$

Explanation:

Magnitude of one of the magnetic fields, $B_1 = 1.2 \times 10^{-2}T$

Magnitude of the other magnetic field = $B_2$

Angle between the two fields,$\theta = 60^\circ$

At stable equilibrium, the angle between the dipole and field $B_1, \theta_1 = 15^\circ$

Angle between the dipole and field $B_2,\ \theta_2 = \theta - \theta_1$ = 60° – 15° = 45°

At rotational equilibrium, the torques between both the fields must balance each other.

∴ Torque due to field $B_1$ = Torque due to field $B_2$ $MB_1 \sin\theta_1 = MB_2 \sin\theta_2$

Where,

M= Magnetic moment of the dipole

$\therefore\ B_2 = \frac{B_1 \sin\theta_1}{\sin\theta_2}$

$= \frac{1.2\times10^{-2}\times\sin 15^\circ}{\sin 45^\circ} = 4.39\times10^{-3}T$

Hence, the magnitude of the other magnetic field is $= 4.39\times10^{-3}T$.

38. (c)

60°

Explanation:

$cos\delta = \frac{B_H}{B} = \frac{3\times10^{-5}}{6\times10^{-5}} = 0.5$

hence angle of dip = 60°

39. (a)

F

Explanation:

$F\alpha\frac{q_m q'_m}{r^2}$

Hence $\frac{F'}{F} = (\frac{2q_m 2q'_m}{4r^2})/\frac{q_m q'_m}{r^2} = 1$

or F' = F

40. (a)

72.5mA

Explanation:

$B = \frac{\mu_o\mu_r Ni}{2\pi r}$

$i = \frac{B.2\pi r}{\mu_o\mu_r N}$

$= \frac{0.35\times0.29\times10^{-2}}{4\pi\times10^{-7}\times1400\times500}$

$= 72.5\times10^{-3}A$

**Solution**

**Class 12 - Chemistry**

**Multiple Choice Questions Test(August 2019)**

**Section A**

41. (a)

$H_2S$

Explanation:

$Pb^{2+} + S^{2-} \rightarrow PbS\,(black)$

$(CH_3COO)_2Pb\ +\ H_2S \rightarrow\ PbS\ + 2CH_3COOH$

42. (d)

$KClO_3$

Explanation:

$Cl_2$ on treatment with conc. Base form $ClO_3^-$ ion.

$Cl_2 + 6KOH \rightarrow 5KCl + KClO_3 + 3H_2O$

43. (d)

12

Explanation:

$2KClO_3 \rightarrow 2KCl\ +\ 3O_2$

2mol of $KClO_3$ gives 3 mol of $O_3$.

So 8 mol of potassium chlorate will yield = $\frac{8\ \times\ 3}{2}$ = 12 mol of $O_2$.

44. (a)

$H_2O$

Explanation:

Stability of hydrides decreases down the group so most stable is $H_2O$. The thermal stability decreases as the atomic mass increases. Water dissociates at $2000^0$C while tellurium hydride, $H_2Te$ decomposes at room temperature. This is due to an increase in the bond length of M-H (M- O, S, Se, Te).

Thus the thermal stability decreases as the atomic size increases. As with the increase in atomic size, the bond length also increases which decreases the thermal stability.

45. (c)

$N_2O$

Explanation:

$N_2O$ is also known as Laughing gas. when inhaled in moderate quantity, it produces a hysterical laughter.

46. (d)

$Xe[PtF_6]$

Explanation:

Bartlett in 1962 prepared $Xe[PtF_6]$ . He passed orange red vapours platinum hexa fluoride over xenon to form yellow solid of xenon platinum hexa fluoride.

$PtF_6 + Xe \rightarrow Xe[PtF_6]$ xenon hexafluoroplatinate(V)

47. (d)

$2HI + H_2SO_4 \longrightarrow I_2 + SO_2 + 2H_2O$

Explanation:

$2HI + H_2SO_4 \longrightarrow I_2 + SO_2 + 2H_2O$

Concentrated sulphuric acid is a good oxidising agent. it oxidises HI to $I_2$.

48. (c)

Dehydrated

Explanation:

Concentrated $H_2SO_4$ is a dehydrating agent and is hygroscopic in nature. So it absorbs water to form black charry mass of carbon.

$$C_{12}H_{22}O_{11} \rightarrow 12C\ +\ 11H_2O$$

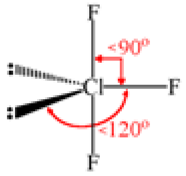
49. (b)

T-shaped

Explanation:

CN=0.5(V+M-C+A) For. $ClF_3$ CN= 5 so hybridisation is sp3d. The structure is trigonal bipyramidal.

$ClF_3$ has 10 electrons around the central atom. this means there are 5 electron pairs arranged in a trigonal bipyramidal shape with a $90^0$ F-Cl-F bond angle. There are 2 equatorial lone pairs making the final structure T- shaped.




50. (b)

+6

Explanation:

The oxidation state of Xe is +6. $XeO_3$ , the oxidation of Xe is calculated as x+3(-2)= 0 gives x= +6.

Similarly, for $XeF_6$ , x + 6(-1) = 0 which is x = +6.

51. (c)

By heating $MnO_2$ and HCl

Explanation:

$MnO_2$ and HCl react to form $Cl_2$.

$$MnO_2(s) + \ 4HCl(l) \ \rightarrow MnCl_2(s) \ + \ 2H_2O(l) \ + \ Cl_2(g)\uparrow$$

52. (d)

$Br_2$

Explanation:

$Br^-$ get oxidized to $Br_2$ on treatment with $H_2SO_4$.

$2KBr + 2H_2SO_4 \rightarrow K_2SO_4 + SO_2\uparrow + Br_2\uparrow + 2H_2O$.

Concentrated sulphuric acid oxidises HBr to Bromine.

53. (d)

$Th^{232}$

Explanation:

$Th^{232}$ can decay to give two noble gases. They are radon and xenon. Any sample of thorium or its compounds contain traces of these daughters, which are isotopes of thallium, lead, bismuth, polonium, radon, radium, and actinium.$^{232}$Th also very occasionally undergoes spontaneous fission rather than alpha decay, to form xenon gas as a fission product.

54. (a)

NaF and $O_2$

Explanation:

Fluorine reacts with conc. NaOH to produce NaF and $O_2$. But with dilute alkali it forms $OF_2$ and NaF.

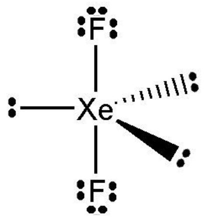
$2F_2 + 4NaOH \rightarrow 4NaF + 2H_2O + O_2\uparrow$

55. (a)

Linear

Explanation:

CN=0.5(V+M-C+A) For $XeF_2$ CN = 5 .So shape will be linear and structure will be trigonal bipyramidal. Xenon and the two fluorine atoms lie in a straight line while the three equatorial positions are occupied by three lone pairs of electrons. Hence it has a linear shape.




56. (a)

Dimethylglyoxime

Explanation:

$Ni^{2+}$ forms complex with DMG which is red in colour.

57. (a)

$Cr_2O_7^{2-}$

Explanation:

Chromate ion ($CrO_4^{2-}$) changes to dichromate ion ($Cr_2O_7^{2-}$ ) on acidification.

$2\ CrO_4^{2-} + 2\ H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

58. (b)

$H_2CrO_4$

Explanation:

$H_2CrO_4$ is chromic acid. It is actually formed by mixing concentrated sulphuric acid to a dichromate like sodium dichromate. It is a strong acid as it completely dissociates into $H^+$ ions.

59. (d)

filling of 4f before 5d

Explanation:

This effect is particularly pronounced in the case of lanthanides, as the 4*f* subshell which is filled before 5d is not very effective at shielding the outer shell (n=5 and n=6) electrons. Thus the shielding effect is less able to counter the decrease in radius caused by increasing nuclear charge. This leads to "lanthanoid contraction".

60. (c)

Fm

Explanation:

In chemistry, a synthetic element is a chemical element that does not occur naturally on earth, and can only be created artificially. So far, 24 synthetic elements have been created (those with atomic numbers 95–118). All are unstable, decaying with half-lives ranging from 15.6 million years to a few hundred microseconds. Fm have atomic number of 100.

61. (b)

Hg

Explanation:

Tin(II) chloride react with mercury(II) chloride in acidic medium to produce mercury and tin(IV) chloride as given below:

$SnCl_2 + HgCl_2 \rightarrow Hg + SnCl_4$

62. (b)

$MnO_2$

Explanation:

In alkaline medium, reduction of $MnO_4^-$ take place to form $MnO_2$. The chemical equation for this change is given below as:

$MnO_4^-(aq) + 2H_2O(l) + 3e^- \rightarrow MnO_2(s) + 4OH^-(aq)$

63. (d)

charge transfer

Explanation:

The oxidation state of Mn in $MnO_4^-$ is +7. Which means that Mn does not have any unpaired d-electrons left. However, $MnO_4^-$ is deep purple in colour because of charge transfer from the ligand ($O^{2-}$) to the metal center. This is called a ligand-to-metal charge transfer.

64. (d)

$Cu^{2+}$

Explanation:

$Cu^{2+}$ have electronic configuration of [Ar] $3d^9$ with presence of one unpaired electron which is responsible for paramagnetism with magnetic moment of 1.8

- 2.2. It shows blue colour due to d-d transition of this unpaired electron in visible region.

65. (c)

$Mn_2O_7$

Explanation:

In $Mn_2O_7$, each Mn is tetrahedrally surrounded by oxygen including Mn-O-Mn bridge.

66. (a)

Zn

Explanation:

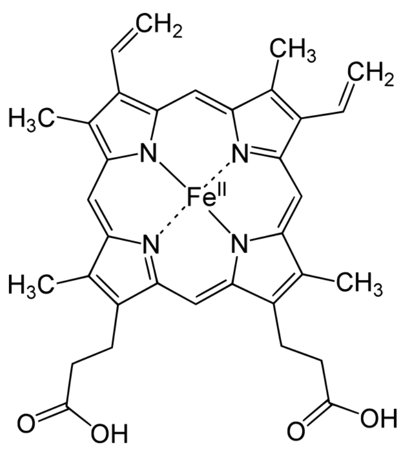
Zinc, cadmium and mercury of group 12 have full $d^{10}$ configuration in their ground state as well as in their common oxidation states and hence, are not regarded as transition metals. However, being the end members of the three transition series, their chemistry is studied along with the chemistry of the transition metals.

67. (b)

Fe

Explanation:

$O_2$ is carried in the haemoglobin protein by the heme group. The heme group (a component of the haemoglobin protein) is a metal complex, with iron as the central metal atom, that can bind or release molecular oxygen. The structure of haemoglobin is as given below:




68. (c)

$Mn^{2+}$

Explanation:

$Mn^{2+}$ has $d^5$ configuration so maximum number of unpaired electrons and hence maxium magnetic moment. This magnetic moment can be calculated by using the spin only formula: $\mu_{so} = \angle n(n+2)$ , where n= number of unpaired electrons.

69. (c)

Sodium nitroprusside

Explanation:

$Na_2[Fe(CN)_5NO]$ i.e. Sodium pentacyanonitrosylferrate(II) is also called Sodium nitroprusside.

70. (c)

$[Ni(NH_3)_4]^{2+}$

Explanation:

Ni has atomic number 28, so $Ni^{2+}$ has electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8$. $NH_3$ is a weak field ligand and hence two electrons are unpaired and hence this complex is paramagnetic.

71. (b)

$[Pt(NH_3)_5Cl]Cl_3$

Explanation:

On getting ionised this complex gives 3 $Cl^-$ (ions outside the square brackets are ionisable) and a $[Pt(NH_3)_3Cl]^+$ i.e. 4 ions are produced per molecule of the compound.

72. (a)

Potassium trioxalatoaluminate(III)

Explanation:

Cation is named first and then the anion separated by a space. In a coordination complex, name of ligand is written first then the central metal atom/ion with its oxidation state in the parenthesis in roman numerals is mentioned. If the complex is an anion then -ate is added to the name of the central metal atom/ion. Here there are 3 $K^+$ ions so cations have a charge of +3. So overall charge on the complex anion is -3. Now each oxalate ion carries -2 charge and there are 3 oxalate ligands attached to aluminium. Let oxidation state of Al be x.

$x + 3(-2) = -3$

$x - 6 = -3$

$x = -3 + 6 = +3$

So, oxidation state of Al=+3

So, the name of the complex is Potassium trioxalatoaluminate(III)

73. (a)

$K^+[PtCl_3(C_2H_4)]^-$

Explanation:

Potassium trichloro(ethylene)platinate(II) i.e. $K[PtCl_3(C_2H_4)]$ is zeise's salt.

74. (b)

Cis – Platin

Explanation:

Cis-platin ( cis – $[Pt(NH_3)_2(Cl)_2]$ ) is a coordination compounds used in treatment of cancer. It inhibits the growth of tumors.

75. (b)

$[Cr(NH_3)_6][Co(CN)_6]$

Explanation:

Coordination isomerism arises from the interchange of ligands between cationic and anionic entities of different metal ions present in a complex. Here interchange of $CN^-$ and $NH_3$ ligands is possible between Cr and Co to give $[Co(NH_3)_6][Cr(CN)_6]$. So this complex can exhibit coordination isomerism.

76. (a)

Linkage isomerism

Explanation:

$SCN^-$ is an ambidentate ligand i.e it can bind through two different donor atoms, either through S in $SCN^-$ or through N in $NCS^-$ . So it shows linkage isomerism which arises when an ambidentate ligand is present in the complex.

77. (d)

$sp^3d^2$

Explanation:

Given complex can be written as $K_3[CoF_6]$. There are 3 Potassium ions $K^+$ means an overall +3 charge on cations and so the charge on the complex anion is -3. Each $F^-$ ligand has -1 charge so there is a total of -6 charge on ligands. Let oxidation state of Co (Z=27) be x

$x + (-6) = -3$

$x = -3 + 6 = +3$

So oxidation state of Co=+3 and its electronic configuration is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$ . Since its a high spin complex means there is no pairing of electrons in 3d subshell. Coordination number of Co is 6 as there are 6 ligands bound to it, so this octahedral complex has hybridization $sp^3d^2$.

78. (d)

both σ and π character.

Explanation:

The metal-carbon bond in metal carbonyls possesses both σ and π character. The M–C σ bond is formed by the donation of lone pair of electrons on the carbonyl carbon into a vacant orbital of the metal. The M–C π bond is formed by the donation of a pair of electrons from a filled d orbital of metal into the vacant antibonding π* orbital of carbon monoxide. The metal to ligand bonding creates a synergic effect which strengthens the bond between CO and the metal.

79. (a)

Titration with EDTA

Explanation:

Hardness of water is because of presence of $Ca^{2+}$ and $Mg^{2+}$ ions which can form stable complexes with EDTA. So by simple titration with EDTA, hardness of water can be estimated. The selective estimation of these ions can be done due to difference in the stability constants of their complexes with EDTA.

80. (d)

$[Ti(NO_3)_4]$

Explanation:

Ti has atomic number 22. And its electronic configuration is $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$.

In given complex, there are four $NO_3^-$ groups bonded to Ti. Each $NO_3^-$ carries -1 charge, hence there is -4 charge on the ligands and overall the complex is neutral which means Ti is in +4 oxidation state. So $Ti^{4+}$ has an electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6$ means there are no electrons in d orbital and hence d-d transition is not possible. So it is expected to be colourless.

## Solution

## Class 12 - Mathematics

## Multiple Choice Questions Test(August 2019)

## Section A

81. (b)

    – tan x

    Explanation:

    Let y = $\sin^3$x and z = $\cos^3$x, then , $\frac{dy}{dz}=\frac{\frac{dy}{dx}}{\frac{dz}{dx}}=\frac{3\sin^2 x\cos x}{3\cos^2 x(-\sin x)}=-\tan x$

82. (b)

    $\frac{1}{2}$

    Explanation:

    $\frac{d}{dx}\left(\tan^{-1}(\sec x+\tan x)\right)=\frac{\sec x\tan x+\sec^2 x}{1+(\sec x+\tan x)^2}=\frac{\sec x(\sec x+\tan x)}{2\sec x(\sec x+\tan x)}=\frac{1}{2}$

83. (c)

    – 1

    Explanation:

    $\frac{dy}{dz}=\frac{\frac{d}{dx}(\tan^{-1}x)}{\frac{d}{dx}(\cot^{-1}x)}=\frac{\frac{1}{1+x^2}}{-\frac{1}{1+x^2}}=-1$

84. (c)

    – sin(sin x)

    Explanation:

    Let y = cos(sinx), z = sinx , then , $\frac{dy}{dz}=\frac{\frac{dy}{dx}}{\frac{dz}{dx}}=\frac{-\sin(\sin x)\cos x}{\cos x}=-\sin(\sin x)$

85. (c)

    $\frac{ab}{y^3}$

    Explanation:

    $y^2=ax^2+b\Rightarrow 2y\frac{dy}{dx}=2ax\Rightarrow y\frac{dy}{dx}=ax$

    $\Rightarrow\frac{dy}{dx}=\frac{ax}{y}\Rightarrow\frac{d^2y}{dx^2}=\frac{ya-ax\frac{dy}{dx}}{y^2}$

    $=\frac{ya-ax\frac{ax}{y}}{y^2}=\frac{a(y^2-ax^2)}{y^3}=\frac{ab}{y^3}$

86. (c)

    $f(x)\frac{d}{dx}\{\log(f(x))\}$

Explanation:
$\frac{d}{dx}(f(x)) = \frac{d}{dx}\left(e^{\log f(x)}\right) = e^{\log f(x)} \frac{d}{dx}(\log f(x)) = f(x) \frac{d}{dx}(\log f(x))$

87. (b)

is equal to 0

Explanation:

$\lim\limits_{x \to 0^-} f(x) = \lim\limits_{x \to 0^-} e^{\frac{1}{x}} = 0, \ \lim\limits_{x \to 0^+} f(x) = \lim\limits_{x \to 0^+} x = 0 \therefore \lim\limits_{x \to 0} f(x) = 0$

88. (b)

an even function

Explanation:

The derivate of an odd function is an even function

89. (b)

-1 < x < 1

Explanation:
$\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$ , is valid only if , $1 - \ x^2 > \ 0$, i.e. if $x^2 < \ 1 \ i.e. \ if \ |x| < \ 1$

90. (d)

all $x \in (\mathbf{R} - \mathbf{I})$

Explanation:

f(x) = x -[x] is derivable at all x ∈ R – I , and f ‘(x) = 1 for all x ∈ R – I .

91. (b)

$\frac{\sin^2(a+y)}{\sin a}$

Explanation:

$x \sin(a+y) = \sin y \ \Rightarrow x = \frac{\sin y}{\sin(a+y)}$

$\Rightarrow \frac{dx}{dy} = \frac{\sin(a+y) \cos y - \sin y \cos(a+y)}{\sin^2(a+y)}$

$= \frac{\sin(a+y-y)}{\sin^2(a+y)} = \frac{\text{sina}}{\sin^2(a+y)}$

$\Rightarrow \frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$

92. (d)

cosec x

Explanation:

$\frac{d}{dx}\left(\log\left|\tan\frac{x}{2}\right|\right)$
$= \frac{1}{\left(\left|\tan\frac{x}{2}\right|\right)}\frac{d}{dx}\left(\tan\frac{x}{2}\right) = \frac{1}{\left(\left|\tan\frac{x}{2}\right|\right)}\frac{1}{2}\sec^2\frac{x}{2} = \frac{1}{2\sin\frac{x}{2}\cos\frac{x}{2}} = \frac{1}{\sin x} = cosecx$

93. (a)

f (x) is not differentiable at x = 0

Explanation:

f is defined on the left of x = 0, therefore, f is neither continuous nor differentiable at x = 0

94. (a)

2

Explanation:

$\lim\limits_{x\to0}\frac{x(e^{\sin x}-1)}{1-\cos x}$
$= \lim\limits_{x\to0}\frac{\frac{(e^{\sin x}-1)}{x}}{\frac{1-\cos x}{x^2}} = \lim\limits_{x\to0}\frac{(e^{\sin x}-1)}{\sin x}.\frac{\sin x}{x}.2 = 2\left(\because \lim\limits_{x\to0}\frac{1-\cos x}{x^2} = \frac{1}{2}\right)$

95. (d)

$\frac{\pi}{4}+\frac{1}{2}$

Explanation:

$f'(x) = \frac{d}{dx}(x\tan^{-1}x) = \frac{x}{1+x^2}+\tan^{-1}x \Rightarrow f'(1) = \frac{1}{1+1}+\tan^{-1}1 = \frac{1}{2}+\frac{\pi}{4}$

**96.** (a)

– tan t

Explanation:

$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{3a\sin^2t\cos t}{3a\cos^2t(-\sin t)} = -\tan t$

97. (a)

f ‘ (x) = g ‘ (x)

Explanation:

$g(x) = \tan^{-1}\left(\frac{1+x}{1-x}\right) \Rightarrow g'(x) = \frac{1}{1+\left(\frac{1+x}{1-x}\right)^2}\frac{(1-x).1-(1+x).(-1)}{(1-x)^2} = \frac{1}{(1+x^2)}$

98. (c)

$\frac{3\sin x-3^4\sin 3x}{4}$

Explanation:

$\frac{d}{dx}(\sin^3x) = 3\sin^2x\cos x$
$\frac{d^2}{dx^2}(\sin^3x) = \frac{d}{dx}(3\sin^2x\cos x) = 6\sin x\cos^2x-3\sin^3x$

$\frac{d^3}{dx^3}(\sin^3 x) = \frac{d}{dx}(6\sin^2 x\cos^2 x - 3\sin^3 x)$
$= 6\cos^3 x - 12\sin^2 x\cos x - 9\sin^2 x\cos x = 6\cos^3 x - 21\sin^2 x\cos x$
$\frac{d^4}{dx^4}(\sin^3 x) = \frac{d}{dx}(6\cos^3 x - 21\sin^2 x\cos x) = -18\cos^2 x\sin x - 42\sin x\cos^2 x + 21\sin^3 x$
$= 60\sin x\cos^2 x + 21\sin^3 x = -60\sin x(1 - \sin^2 x) + 21\sin^3 x$
$= -60\sin x + 60\sin^3 x + 21\sin^3 x = -60\sin x + 81\sin^3 x$
$= -60\sin x + 81\left[\frac{3\sin x - \sin 3x}{4}\right] = \frac{3\sin z - 3^4\sin 3z}{4}$

99. (d)

$\frac{1}{x}$

Explanation:

$\frac{d}{dx}(\log|x|) = \frac{1}{|x|}\frac{x}{|x|} = \frac{x}{|x|^2} = \frac{x}{x^2} = \frac{1}{x}$

100. (d)

f ‘ (0) for all $x \in \mathbf{R}$

Explanation:

$$f'(x) = \lim_{h\to 0}\frac{f(x+h) - f(x)}{h}$$

= $\lim_{h\to 0}\frac{f(x+h)-f(x+0)}{h} = \lim_{h\to 0}\frac{f(x)+f(h)-(f(x)+f(0))}{h} = \lim_{h\to 0}\frac{f(h)-f(0)}{h} = f'(0)$

101. (c)

x + y = 0

Explanation:

Since , $\frac{dy}{dx} = \cos x,$ therefore , slope of tangent at ( 0 , 0 ) = cos 0 = 1 and hence slope of normal at ( 0 , 0 ) is - 1 .

Equation of normal at (0,0) is,

y - 0 = slope of normal $\times$( x - 0)

y = -1(x)

x + y = 0

102. (d)

$x = \frac{1}{e}$

Explanation:

Consider f(x) = y =$x^x$

Then, log y = log $x^x$ = x.logx

$\Rightarrow f'(x) = x^x(1 + \log x)$
$\Rightarrow (1 + \log x) = 0 \ldots\ldots (\because x^x \neq 0)$

$\Rightarrow \log x = -1 \Rightarrow x = e^{-1}.$

103. (d)
parallel

Explanation:

Given y =$x^3$ + 3x

$\Rightarrow \frac{dy}{dx} = 3x^2 + 3$

Slope of tangent at x = 1 = 6 and

Slope of tangent at x = -1 = 6

Hence, the two tangents are parallel.

104. (a)
at right angles

Explanation:

$x^2 + y^2 = 2 \Rightarrow 2x + 2y\frac{dy}{dx} = 0 \Rightarrow \frac{dy}{dx} = \frac{-x}{y}$ therefore , slope of tangent at (1,1) = - 1 and the slope of tangent at ( - 1 ,1 )= 1 .

Now product of the slopes=1×-1= -1

Hence , the two tangents are at right angles.

105. (a)
point of inflexion at x = 0

Explanation:

Given f(x) = $x^3$

f'(x) = $3x^2$

For point of inflexion, we have f'(x) = 0

$f'(x) = 0 \Rightarrow 3x^2 = 0 \Rightarrow x = 0$

Hence, f(x) has a point of inflexion at x = 0.

But x = 0 is not a local extremum as we cannot find an interval I around x = 0 such that

$f(0) \geq f(x) \quad or \quad f(0) \leq f(x) \qquad for \quad all \quad x\epsilon I$

106. (a)
a = 1, b = – 2, c = 1

Explanation:

$y = ax^3 + bx^2 + cx$

$\Rightarrow \frac{dy}{dx} = 3ax^2 + 2bx + c.$

At ( 0 , 0) , slope of tangent =$\tan 45^\circ$ = 1.⇒ c = 1. At ( 1 ,0 ) , slope of tangent = 0.

⇒3a+2b+c=0. From this,we get ,3a+2b=-1........(1)

Also, when x = 1 , y = 0 , therefore , a + b + c = 0 . From this,we get, a+b=-1.......(2)

From(1) and (2),we get,

a=1 ,b= -2 and c =1

107. (a)

local minima at x = 1

Explanation:

Given, f(x) = $x^3$ - 3x

f'(x) = $3x^2$ - 3

For point of inflexion we have f'(x) = 0

$f'(x) = 0 \Rightarrow 3x^2 - 3 = 0 = 3(x-1)(x+1) \Rightarrow x = \pm 1$

Hence, f(x) has a point of inflexion at x = 0.

When , x is slightly less than 1, f'(x) = (+)(-)(+) i.e, negative

When x is slightly greater than 1, f'(x)= (+)(+)(+) i.e, positive

Hence, f'(x) changes its sign from negative to positive as x increases through 1 and hence x = 1 is a point of local minimum.

108. (b)

only one minima

Explanation:

Given,$f(x) = |x| = \begin{matrix} -x, & x < 0 \\ x, x > 0 \end{matrix}$

$\Rightarrow f'(x) = -1$ when x< 0 and 1 when x > 0

But, we have f'(x) does not exist at x = 0, hence we have x = 0 is a critical point

At x = 0, we get f(0) = 0

For any other value of x, we have f(x) > 0 , hence f(x) has a minimum at x= 0.

109. (b)

local minima at x = 2 and a local maxima at x = – 2

Explanation:

Given , f(x) = x + $\frac{4}{x}$

$\Rightarrow f'(x) = 1 - \frac{4}{x^2}$

$\Rightarrow f'(x) = 0$

$\Rightarrow x = \pm 2$

$\Rightarrow f''(x) = \frac{8}{x^3}$

$\Rightarrow f''(2) = \frac{8}{8} = 1 > 0$

$\Rightarrow f''(-2) = \frac{8}{-8} = -1 < 0$

So, f(x) has a local minima at x = 2 and a local minima at x= -2.

110. (c)

$\frac{3}{4}$

Explanation:

Given, f(x) = $x^2$ + x +1

$\Rightarrow$ f'(x) = 2x + 1

For minimum value of f(x) we have f'(x) = 0

$\Rightarrow$ 2x + 1 = 0 $\Rightarrow$ x = $\frac{-1}{2}$

Now, f''(x) = 2 >0, hence the minimum of f(x) exist at x = $\frac{-1}{2}$ and minimum value = f($\frac{-1}{2}$) = $\frac{3}{4}$

111. (b)

-34.995

Explanation:

f(x) = $x^3$ - 7$x^2$ +15

Let x = 5 and $\Delta x$= 0.001

Then, f(5.001) = f(x+$\Delta x$) = (x+$\Delta x$)$^3$ - 7(x+$\Delta x$)$^2$ + 15

Now, $\triangle y = f(x + \triangle x) - f(x)$

$\therefore f(x + \triangle x) = f(x) + \triangle y$

$\approx f(x) + f'(x). \triangle x$

$f(5.001) \approx \left(x^3 - 7x^2 + 15\right) + \left(3x^2 - 14x\right) \triangle x$

$= (5)^3 - 7(5)^2 + 15 + \left[3(5)^2 - 14(5)\right].(0.001)$

$= 125 - 175 + 15 + (75 - 70).(0.001)$

$= -35 + 5.(0.001) = -34.995$

112. (c)

1

Explanation:

x = $a\cos^3\theta$ , y = $a\sin^3\theta$

= $\frac{dx}{d\theta} = -3acos^2\theta sin\theta, \frac{dy}{d\theta} = 3asin^2\theta cos\theta$

Slope of tangent = $= \frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{-3acos^2\theta sin\theta}{3asin^2\theta cos\theta} = -tan\theta$

Slope of normal is $\frac{-1}{\frac{dy}{dx}} = \frac{-1}{-tan\theta} = cot\theta$

When , Slope of normal $= cot\frac{\pi}{4} = 1$

113. (b)

e

Explanation:

$f(x) = \frac{x}{\log x}$

$\Rightarrow f'(x) = \frac{logx.1 - x.\frac{1}{x}}{(\log x)^2}$

For maximum or minimum values of x we have f'(x) = 0

$f'(x) = 0 \Rightarrow \frac{\log x - 1}{(\log x)^2} = 0 \Rightarrow (\log x - 1) = 0$

$\Rightarrow \log x = 1 \Rightarrow x = e$

Now, $f''(x) = (\log x - 1)\frac{-2}{(\log x)^3} \quad + (\log x)^{-2}.\frac{1}{x}$

$f''(e) = \frac{1}{e} > 0$

Hence, f(x) has a minimum value f(e) = e.

114. (d)

relative minimum > relative maximum

Explanation:

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

Then, f'(x) = 1 - $\frac{1}{x^2}$

For, relative maximum and minimum values of x, we have f'(x) =0

$\Rightarrow$ 1 - $\frac{1}{x^2}$ = 0

$\Rightarrow$ $x^2$ = 1

$\Rightarrow$ x = $\pm 1$

Now, f''(x) = $\frac{2}{x^3}$

When , x = 1, we get f''(x) = 2>0 and when x= -1, we get f''(x) = -2 <0

f(x) = x + $\frac{1}{x}$ has a local maximum at x = -1 and a local minimum at x= 1.

Now, the maximum value = f(-1) =-2 and minimum value = f(1) =2

115. (d)

S has atleast one point

Explanation:

Since, given f(x) is differentiable in (2,3) and f(2) = f(3) we have conditions of Rolle's theorem are satisfied by f(x) in [2,3].

Hence, there exist atleast one real c in (2,3) s.t.f'(c) = 0.

Therefore, the set S contains atleast one element.

116. (d)

$\frac{x}{a} + \frac{y}{b} = 2$

Explanation:

Given curve is $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$

$\Rightarrow n\left(\frac{x}{a}\right)^{n-1}\frac{1}{a} + n\left(\frac{y}{b}\right)^{n-1}\frac{1}{b}\frac{dy}{dx} = 0$

$\Rightarrow \frac{dy}{dx} = \frac{-b}{a}\left(\frac{xb}{ya}\right)^{n-1}$

Hence, Slope of tangent at (a,b)= $\frac{-b}{a}$

Therefore, equation of tangent at (a,b) is ( y - b)= $\frac{-b}{a}(x-a)$

$\Rightarrow$ a(y - b) = -b(x - a)

$\Rightarrow$ bx + ay = 2ab

$\Rightarrow \frac{x}{a}+\frac{y}{b}=2$

117. (c)

$e^{\pi}>\pi^{e}$

Explanation:

Let y = f(x) = $x^{\frac{1}{x}}$

Then, log y = log $x^{\frac{1}{x}}$ = $\frac{1}{x}$. logx

$\Rightarrow \frac{1}{y}\frac{dy}{dx}=\frac{1}{x}.\frac{1}{x}+logx.\frac{-1}{x^2}=\frac{1-\log x}{x^2}$

$\Rightarrow f'(x)=x^{\frac{1}{x}}(\frac{1-\log x}{x^2})$

$f'(x)=0\Rightarrow(1-\log x)=0 \ldots\ldots (\because x^{\frac{1}{x}}\neq 0)$

$\Rightarrow \log x=1\Rightarrow x=e$

$\therefore f\ (e)>f\ (\ \pi\ )$

$\Rightarrow e^{\frac{1}{e}}>\pi^{\frac{1}{\pi}}$

$\Rightarrow \left(e^{\frac{1}{e}}\right)^{\pi e}>\left(\pi^{\frac{1}{\pi}}\right)^{\pi e}$

$\Rightarrow e^{\pi}>\pi^{e}$

118. (b)

f ‘(x) exists for all x

Explanation:

Since $[x-\pi]$ is an integer for all $x\in R$ & $\tan n\pi\ =0\ \forall\ n\ \in I$ .Therefore, f(x)= 0 for all x in R. So, f(x) is a constant and hence derivatives of f(x) of all order exist.

119. (a)

a vertical tangent

Explanation:

$y=x^{\frac{1}{5}}$

$\frac{dy}{dx}=\frac{1}{5}x^{\frac{-4}{5}}$

when x= 0, Slope of the tangent $\frac{dy}{dx}=\infty$

Which means the tangent is parallel to Y - axis implies the tangent is vertical.

120. (a)

ty = x +at$^2$

Explanation:

$y^2 = 4ax$

$\Rightarrow 2y\frac{dy}{dx} = 4a$

$\Rightarrow \frac{dy}{dx} = \frac{2a}{y}$

$\Rightarrow \frac{dy}{dx}$ at $\left(at^2, 2at\right)$ is $\frac{2a}{2at} = \frac{1}{t}$

$\Rightarrow$Slope of tangent $= m = \frac{1}{t}$

Hence, equation of tangent is $y - y_1 = m\left(x - x_1\right)$

$\Rightarrow y - 2at = \frac{1}{t}(x - at^2)$

$\Rightarrow yt - 2at^2 = x - at^2$

$\Rightarrow yt = x + at^2$