Atomic Energy Central School No 4 Rawatbhata

Multiple Choice Questions Examination (November 2019-20)

MM: 120 Class XI (Physics, Chemistry, Mathematics) Time:3hour

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Name of student : _____Roll No._____Class Sec_____

Date: _____ Invigilator's Sign: _____

Physics

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

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

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

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

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

   a) 11.36 m/s b) 8.13 m/s
   c) 10.36 m/s d) 9.36 m/s

4. The change in kinetic energy of a particle is equal to the **1**

   a) work done on it by some force b) work done on it by the net force
   c) work done on it by the aerodynamic force d) loss in ambient kinetic energy

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

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

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

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

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

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

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

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

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

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

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

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

11. In precession such as that of a top **1**

a) the axis of rotation oscillates horizontally
b) the axis of rotation oscillates vertically
c) the axis of rotation is fixed
d) the axis of rotation moves

12. A body having moment of inertia about its axis equal to 3 kg m^2 is rotating with angular velocity equal to 3 rad/s. The kinetic energy of this rotating body is the same as that of a body of mass 27 kg moving with a speed of **1**

a) 0.5 m/s
b) 1.0 m/s
c) 1.5 m/s
d) 2.0 m/s

13. If the radius of earth contracts to half of its present value, the mass remaining unchanged, the duration of the day will be **1**

a) 48 hrs
b) 6 hrs
c) 24 Hrs
d) 12 Hrs

14. Which of the following has the largest moment of inertia? **1**

a) Solid sphere of mass M and radius R about any axis passing through its centre of mass
b) Bar magnet of mass M and length R about any axis passing through its centre of mass
c) Disc of mass M and radius R about an axis perpendicular to its plane
d) Ring of mass M and radius R about an axis perpendicular to its plane

15. The angular velocity of a body changes form 1 rev/ sec to 16 rev/sec. without applying any external torque. The ratio of its radius of gyration in the two cases is **1**

a) it is 1:16
b) it is 4: 1
c) it is 16:1
d) it is 1:4

16. A thin circular ring of mass M and radius R is rotating about its central axis with angular velocity. Four point objects each of mass m are attached gently to the opposite ends of two perpendicular diameters, the angular velocity of the ring is given by **1**

a) $\frac{M-4m}{M+4m} \cdot \omega$
b) $\frac{M+4m}{M} \cdot \omega$
c) $\frac{M}{M+m} \cdot \omega$
d) $\frac{M}{M+4m} \cdot \omega$

17. A particle performs uniform circular motion with an angular momentum L. If the frequency of particle's motion is doubled and its K.E. is halved, the angular momentum becomes **1**

a) L/4
b) 2L
c) 4L
d) L/2

18. A thin uniform rod of length 2l and mass M is acted upon a constant torque. The angular velocity changes from zero to ω in time t. The value of torque is **1**

a) $\frac{Ml^2\omega}{3t}$
b) $\frac{2Ml^2\omega}{3t}$
c) $\frac{Ml^2\omega}{12t}$
d) $\frac{Ml^2\omega}{t}$

19. The moment of inertia of a solid sphere of density ρ and radius R is given by **1**

a) $\frac{176}{105}\rho R^5$
b) $\frac{176}{105}\rho R^2$
c) $\frac{176}{105}\rho R^3$
d) $\frac{105}{176}\rho R^2$

20. The radius of gyration of a rod of mass 100 gm and length 100 cm about an axis passing through its edge **1**

and perpendicular to its length is given by

a) $\frac{100}{\sqrt{3}}$ b) $\frac{50}{2\sqrt{3}}$

c) $\frac{50}{3\sqrt{2}}$ d) $\frac{100}{3\sqrt{3}}$

21. A flywheel at rest is to reach an angular velocity of 36 rad/sec, in 6 sec, with a constant angular acceleration. The total angle turned during this interval is : **1**

a) 108 rad b) 216 rad

c) 144 rad d) 72 rad

22. In pure translational motion of a rigid body **1**

a) at any instant of time every particle of the body has the same velocity.

b) at any instant of time different particles of the body have different velocities.

c) at any instant of time velocity is dependent on the position vector of a point on the body

d) at different instants of time every particle of the body has the same velocity.

23. A boy comes running and sits on a merry-go-round. What is conserved? **1**

a) Angular momentum b) Linear momentum

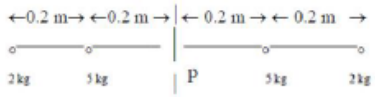
c) Kinetic energy of rotation d) None of these

24. A mass is revolving in a circle, which is in the plane of paper. The direction of angular acceleration if any, is **1**

a) upward from the plane of paper b) Tangential

c) At right angles to the plane of paper. d) towards the radius

25. Four masses are fixed on a mass less rod as shown in figure. The moment of inertia about the axis P is about **1**



a) 0.5 kg metre^2 b) 1.04 kg metre^2

c) 0.3 kg metre^2 d) 2 kg metre^2

26. A particle moves with a constant velocity parallel to the x - axis. Its angular momentum with respect to the origin **1**

a) goes on increasing b) goes on decreasing

c) remains constant d) is zero

27. Let r_i be the position vector of the i^{th} particle having mass m_i and R be the position vector of the centre of mass. The formula for R is **1**

a) $\mathbf{R} = \frac{\sum^{m_i} \mathbf{r_i}}{\sum^{m_1}}$ b) $\mathbf{R} = \frac{\sum^{m_i} \mathbf{r_i}}{\sum^{m_3}}$

c) $\mathbf{R} = \frac{\sum^{m_i} \mathbf{r_i}}{\sum^{m_2}}$ d) $R = \frac{\sum m_i . r_i}{\sum m_i}$

28. A ring of radius r and mass m rotates about its central axis. The kinetic energy is **1**

a) $\text{mr}\ \omega^2\ /2$ b) $\text{mr}^2\ \omega^2\ /2$

c) $\text{mr}\ \omega^2$ d) $\text{mr}^2\ \omega^2$

29. The total momentum of a system of particles is equal to **1**

a) the product of the total mass of the system and the velocity of its centre of mass

b) the product of the total mass of the system and the average velocity of its centre of mass

c) the product of half the total mass of the system and the velocity of its centre of mass

d) the product of the total mass of the system and the speed of its centre of mass

30. If a gymnast sitting on a rotating stool with his arms outstretched, suddenly lowers his hands **1**

a) the angular velocity decreases b) his moment of inertia decreases

c) the angular momentum increases d) the angular velocity stays constant

31. We have two spheres, one is a hollow shell and the other a solid. They have identical masses and moments of inertia about their respective diameters. The ratio of their radii is given by **1**

a) it is 5:7
b) it is 3: 5
c) $\sqrt{(3)} : \sqrt{(7)}$
d) $\sqrt{(3)} : \sqrt{(5)}$

32. The vector product of two vectors a and b is a vector c such that the magnitude of c is given by **1**

a) $|\mathbf{a}||\mathbf{b}|\cos\theta$
b) $|\mathbf{a}||\mathbf{b}|\tan\theta$
c) $|\mathbf{a}||\mathbf{b}|\cot\theta$
d) $|\mathbf{a}||\mathbf{b}|\sin\theta$

33. A planet is revolving round the sun in an elliptical orbit. The maximum and the minimum distances of the planet from the sun are 3×10^{12} m and 2×10^{10} m respectively. The speed of the planet when it is nearest to sun is 2×10^{7} m/sec.what is the speed of the planet when it is farthest from the sun? **1**

a) 1.5×10^{7} m/sec
b) 2.66×10^{5} m/sec
c) 1.33×10^{5} m/sec
d) 3×10^{5} m/sec

34. A wheel is rotating about an axis through its centre at 720 r.p.m. When acted upon by a constant torque opposing its motion for 8 seconds it stops rotating. The value of this torque in Nm is (given I = $\frac{24}{\pi}$ kg m^2) **1**

a) 72
b) 48
c) 96
d) 120

35. In rotation of a rigid body about a fixed axis is that in which **1**

a) every particle of the body moves in a circle, which lies in a plane perpendicular to the axis and has its centre on the axis
b) every particle of the body moves in a ellipse, which lies in a plane perpendicular to the axis and has its focii on the axis
c) particles close to the axis have larger velocities
d) every particle of the body moves at the same speed

36. Two circular rings have their masses in the ratio 1:2 and their diameters in the ratio 2: 1. The ratio of their moments of inertia about their axes is **1**

a) it is 1 :2
b) it is 4: 1
c) it is 2 : 1
d) it is 1: 4

37. The angular velocity of a body changes form 1 rev / sec to 25 rev/sec. without applying any external torque. The ratio of the radii of gyration in the two cases is **1**

a) it is 1: 25
b) it is 25:1
c) it is 5:1
d) it is 1: 5

38. A fan of moment of inertia 0.3 kg m^2 is to run up to a working speed of 0.5 revolution per second. Indicate the correct value of the angular momentum of the fan **1**

a) (π /6) (kg $\times$ m^2) / sec
b) 3(kg $\times$ m^2) / sec
c) 0.3 π kg $\times$ m^2 / sec
d) 6 kg $\times$ m^2/sec

39. The angular velocity of the body changes from ω_1 to ω_2 without applying torque but by changing moment of inertia. The ratio of initial radius of gyration to the final radius of gyration is **1**

a) $\omega_2 : \omega_1$
b) ${\omega_2}^2 : \omega_2$
c) $(1/\omega_2) : (1/\omega_1)$
d) $\sqrt{(\omega_2)} : \sqrt{(\omega_1)}$

40. Considering binary (double) stars in our frame of reference, the trajectories of the stars are a combination of **1**

a)
i. uniform motion in a straight line of the centre of mass and
ii. circular orbits of the stars about the centre of mass

b)
i. uniform motion in a straight line of the centre of mass and
ii. elliptical orbits of the stars about the centre of mass

c)
i. uniform motion in a straight line of the centre of mass and
ii. straight line motion of the stars about the centre of mass

d)
i. uniform motion in a circle of the centre of mass and
ii. circular orbits of the stars about the centre of mass

Chemistry

41. 2 is passed into one dm^3 of a solution containing 0.1 mole of Zn^{2+} and 0.01 mole of Cu^{2+} till the sulphide ion concentration reaches 8.1×10^{-19} moles. Which one of the following statements is true? [K_{sp} of ZnS and CuS are 3×10^{-22} and 8×10^{-36} respectively] **1**

a) Only ZnS precipitates
b) Both CuS and ZnS precipitate
c) Only CuS precipitates
d) No precipitation occurs

42 PCl_5, PCl_3 and Cl_2 are at equilibrium at 500K in a closed container and their concentrations are $0.8 \times 10^{-3} mol\, L^{-1}$, $1.2 \times 10^{-3} mol\, L^{-1}$ and $1.2 \times 10^{-3} mol\, L^{-1}$ respectively. The value of K_c for the reaction $PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g)$ will be 1

a) $1.8 \times 10^{3} mol\, L^{-1}$ b) 1.8×10^{3}

c) 0.55×10^{4} d) $1.8 \times 10^{-3} L\, mol^{-1}$

43. Hydrogen molecule (H) can be dissociated into hydrogen atoms (H). Which one of the following changes will not increase the number of atoms present at equilibrium? 1

a) increasing the total pressure b) increasing the temperature

c) increasing the volume of the container d) adding H atoms

44. Does the number of moles of reaction products increase, decrease or remain same when each of the following equilibria is subjected to a decrease in pressure by increasing the volume? $PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g)$ 1

a) remain the same b) increase

c) decrease largely d) decrease

45. A chemist dissolves an excess of BaSO in pure water at 25°C if its $K_{sp} = 1 \times 10^{-10}$. what is the concentration of barium in the water ? 1

a) 10^{-4} M b) 10^{-6} M

c) 10^{-15} M d) 10^{-5} M

46. When hydrochloric acid is added to cobalt nitrate solution at room temperature, the following reaction takes place and the reaction mixture becomes blue. On cooling the mixture it becomes pink. On the basis of this information mark the correct answer. $[Co\ (H_2O)6]^{3+}\,(aq) + 4Cl^{-}\,(aq) \rightleftharpoons [CoCl_4]^{2-}\,(aq) + 6H_2O\,(l)$ 1

a) $\Delta H = 0$ for the reaction b) $\Delta H < 0$ for the reaction

c) The sign of ΔH cannot be predicted on the basis of this information. d) $\Delta H > 0$ for the reaction

47. pH of a saturated solution o$Ba(OH)_2$ is 12. The value of solubility product (K_{sp}) of $Ba(OH)_2$ is 1

a) 3.3×10^{-7} b) 5×10^{-7}

c) 4.0×10^{-6} d) 5.0×10^{-6}

48. Acidity oBF_3can be explained on the basis of which of the following concepts? 1

a) Lewis concept b) Bronsted Lowry as well as Lewis concept

c) Arrhenius concept d) Bronsted Lowry concept

49. For the reaction $2(g) + I_2\,(g) \rightleftharpoons 2HI$ (g), the standard free energy is $\Delta G^{-} > 0$ The equilibrium constant (K) would be _____. 1

a) K < 1 b) K > 1

c) K = 0 d) K = 1

50. If in a mixture where Q = k is combined, then what happens? 1

a) nothing appears to happen, but forward and reverse are continuing at the same rate b) the reaction shift towards products

c) the reaction shift towards reactants d) nothing happens

51. Calculate the hydrogen ion concentration in the human blood whose pH is 7.38. 1

a) $5.16 \times 10^{-8}\ M$ b) $3.19 \times 10^{-8}\ M$

c) $4.17 \times 10^{-8}\ M$ d) $6.33 \times 10^{18} M$

52. The solubility of $Ca_3(PO_4)_2$ in water is y moles/litre. Its solubility product is 1

a) $6y^4$ b) $64y^5$

c) $36y^4$ d) $108y^5$

53. We know that the relationship between c and p is $K_p = K_c(RT)^{\triangle n_{gas}}$ What would be the value of $\triangle$n gas for the reaction $NH_4Cl\,(s) \rightarrow NH_3\,(g) + HCl\,(g)$ 1

a) 1.5 b) 2.0

c) 0.5 d) 1

54. The ionisation of hydrochloric in water is given below: 1

$HCl\ (aq)\ +\ H_2O\ (l) \rightleftharpoons H_3O^+\ +\ Cl^-$

Label two conjugate acid-base pairs respectively in the ionization.

a) HCl, $H_3O^+$and H_3O^+ ,Cl^- b) HCl, Cl^- and H_2O, H_3O^+ .

c) H_2O, Cl^- and H_3O^+ ,HCl d) H_3O,Cl^- and HCl, H_2O.

55. If in the reaction $2\ O_4 \rightleftharpoons 2NO_2$, x is that part of N_2O_4which dissociates, then the number of molecules at equilibrium will be 1

a) 1 b) 3

c) 1 + x d) $(1\ +\ xy)^2$

56. In which of the following solvents is silver chloride most soluble? 1

a) $0.1\ mol\ dm^{-3}HCl$ solution b) H_2O

c) Aqueous ammonia solution d) 0.1 mol dm^{-3} $AgNO_3$

57. BF_3 does not have proton, but still acts as an acid and reacts with NH_3. choose the correct option. 1

a) BF_3 acts as Lewis acid and coordinate bond is formed. b) BF_3 is a Brönsted base and coordinate bond is formed.

c) BF_3 is a Lewis base and coordinate bond is formed. d) BF_3 is a Brönsted acid and coordinate bond is formed.

58. What is the correct expression for the representation of the solubility product constant of Ag CrO ? 1

a) $[2Ag^+]^2[CrO_4^{2-}]$ b) $[2Ag^+][CrO_4^{2-}]$

c) $[Ag^+]^2[CrO_4^{2-}]$ d) $[Ag^+][CrO_4^{2-}]$

59. Conjugate acid of a weak base is always stronger. What will be the decreasing order of basic strength of the following conjugate bases? OH^-, RO^-, CH_3COO^-, Cl^- 1

a) $CH_3COO^- > Cl^- > RO^- > OH^-$ b) $OH^- > R > CH_3CO >$

c) $RO^- > OH^- > CH_3COO^- > Cl^-$ d) $RO^- > OH^- > Cl^- > CH_3COO^-$

60. Assuming complete dissociation, calculate the pH of 0.002 M KOH solution. 1

a) 10.93 b) 2.01

c) 11.31 d) 10.11 only

61. What will be the value of pH of 0.01 mol dm CH COOH $K_a = 1.74 \times 10^{-5}$) 1

a) 3.6 b) 3.4

c) 3.0 d) 3.9

62. Consider the following gaseous equilibria with equilibrium constants 1 and 2 respectively. 1

$SO_{2(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons SO_{3(g)}$

$2SO_{3(g)} \rightleftharpoons 2SO_{2(g)} + O_{2(g)}$

The equilibrium constants are related as _____.

a) $K_2 = \frac{2}{K_1^2}$ b) $2K_1 = K_2^2$

c) $K_2^2 = \frac{1}{K_1}$ d) $K_1^2 = \frac{1}{K_2}$

63. The ionization constant of HF is $.2\ x10^{-4}$.Calculate the degree of dissociation of HF in its 0.02 M solution. 1
The concentrations of all species present i.e. H_3O^+ , F^- and HF in the solution and its pH respectively are.

a) $5.9 \times 10^{-3}\ M$, $5.9\ \times 10^{-3}\ M$, $19.6 \times 10^{-3}\ M$, 2.62. b) $2.5 \times 10^{-3}\ M$,$2.5 \times 10^{-3}\ M$, 17.6×10^{-3}, 2.62

c) $3.6 \times 10^{-3}\ M$, $3.6\ \times 10^{-3}\ M$, $18.6 \times 10^{-3}\ M$, 2.62. d) $1.4 \times 10^{-3}\ M$, $1.4\ \times 10^{-3}\ M$, $16.6 \times 10^{-3}\ M$, 2.62.

64. At a particular temperature and atmospheric pressure, the solid and liquid phases of a pure substance can exist in equilibrium. Which of the following term defines this temperature? 1

a) Boiling point b) Phase change temperature

c) Normal melting point and Freezing point d) Equilibrium temperature

65. The pH of neutral water at $5^{\circ}C$ is 7.0. As the temperature increases, ionisation of water increases, however, the concentration of H^+ ions and OH^- ions are equal. What will be the pH of pure water at $60^{\circ}C$? 1

a) Less than 7.0
b) Equal to 7.0
c) Greater than 7.0
d) Equal to zero

66. Using the standard electrode potential, find out the pair between which redox reactions is not feasible.E values: Fe^{3+}/Fe^{2+} = +0.77; $I^2/I^-(s)$ = +0.54; Cu^{2+}/Cu = +0.34; Ag^+/Ag = +0.80 1

a) Ag and Fe^{3+}
b) Fe^{3+} and Cu
c) Ag+ and Cu
d) Fe^{3+} and I^-

67. The oxidizing power of halogens increase in the order of 1

a) $I_2 < Br_2 < Cl_2 < F_2$
b) $F_2 < I_2 < Br_2 < Cl_2$
c) $Br_2 < Cl_2 < F_2 < I_2$
d) $Cl_2 < F_2 < I_2 < Br_2$

68. The exhibition of various oxidation states by an element is also related to the outer orbital electronic configuration of its atom. Atom(s) having which of the following outermost electronic configurations will exhibit more than one oxidation state in its compounds. 1

a) $3s^2 3p^3$
b) $3d^2 4s^2$
c) $3d^1 4s^2$
d) $3s^1$

69. For ions composed of only one atom, the oxidation number is equal to the 1

a) always -1
b) always +1
c) sum of different oxidation states
d) charge on the ion

70. The decomposition of hydrogen peroxide to form water and oxygen is an example of 1

a) displacement reactions
b) disproportionation reaction
c) decomposition reactions
d) combination reactions

71. Which of the following halogens do not exhibit a positive oxidation number in their compounds? 1

a) I
b) F
c) Br
d) Cl

72. In the decomposition of lead (II) nitrate to give lead (II) oxide, nitrogen dioxide and oxygen gas, the coefficient of nitrogen dioxide (in the balanced equation) is 1

a) 1
b) 2
c) 3
d) 4

73. Consider the elements: Cs, Ne, I and F. Identify the element(s) that exhibits only negative oxidation state 1

a) s
b) F
c) Cs and F
d) I

74. Hydrogen is prepared from H O by adding 1

a) AI, which acts as oxidising agent
b) Au, which acts as oxidising agent
c) Ca, which acts as reducing agent
d) Ag, which acts as reducing agent

75. In the free or the uncombined state, each atom in O O ,P S and Mg has the oxidation number 1

a) two
b) seven
c) zero
d) three

76. In the reaction $H_2O_2 \rightarrow 2H_2O + O_2$ 1

a) Oxygen is reduced only
b) Oxygen is oxidised only
c) Oxygen is neither oxidised nor reduced
d) Oxygen is oxidised as well as reduced

77. Which of the following elements does not show disproportionation tendency? 1

a) Br
b) F
c) I
d) Cl

78. Identify the correct statements with reference to the given reaction $4 + 3OH^- \rightarrow PH_3 + 3H_2PO_2^-$. 1

a) Hydrogen is undergoing oxidation as well as reduction
b) Phosphorus is undergoing oxidation only.
c) Phosphorus is undergoing reduction only.
d) Phosphorus is undergoing oxidation as well as reduction.

79. 2 Na(s) ----------> 2Na + 2e 1

$2H^+ + 2\ e^-$ --------> H_2

Which is oxidizing and Reducing?

a) sodium is reduced
b) hydrogen is oxidised
c) sodium is oxidised and hydrogen is reduced
d) electronegativity of sodium determines the direction of the reaction

80. An oxidation number of +2 is found in all their compounds of one of the below given options 1

a) all alkaline earth metals
b) superoxides
c) all alkali metals
d) all transition elements

Mathematics

81. If the points representing the complex numbers - 4 +3i , 2 – 3i and 0 + pi are collinear , then the value of p is 1

a) 1
b) - 1
c) 2
d) none of these

82. Two points (a , 0) and (0 , b) are joined by a straight line. Another point on this line is 1

a) (- 3a , 2b)
b) (a , - 2b)
c) none of these
d) (3a , - 2b)

83. The equations of the lines through (1 , 1) and making angles of 5^0 with the line x + y = 0 1

a) x – y = 0 , y – 1 = 0
b) none of these
c) x – 1 = 0 , y – 1 = 0
d) x – 1 = 0 , x – y = 0

84. If a , b , c are in A . P. then straight line ax + by + c = 0 will always pass through a fixed point whose coordinates are 1

a) (- 1 , - 2)
b) (1 , - 2)
c) (1 , 2)
d) none of these

85. A line L passes through the points (1 , 1) and (2 , 0) and another line M which is perpendicular to L passes through the point (1/2 , 0) . The area of the triangle formed by these lines with y axis is : 1

a) 25/8
b) 25/16
c) none of these
d) 25/4

86. The distance between the lines 3x + 4y = 9 and 6x + 8y = 15 is 1

a) 7/10
b) 3/10
c) 2/3
d) 3/2

87. The straight lines x + y = 0 , 3x + y – 4 = 0 , x + 3y – 4 = 0 form a triangle which is 1

a) equilateral
b) isosceles
c) none of these
d) right angled

88. The acute angle between the lines y = 2x and y = - 2x is 1

a) greater than 60^0
b) 90^o
c) less than 60^0
d) 60^0

89. The line segment joining the points (1 , 2) and (- 2 , 1) is divided by the line 3x + 4y = 7 in the ratio 1

a) it is 3:4
b) it is 4:9
c) it is 9:4
d) it is 4:3

90. The point on the axis of y which is equidistant from (- 1 , 2) and (3 , 4) is 1

a) (0 , 4)
b) none of these
c) (5 , 0)
d) (0 , 5)

91. The area of the triangle whose sides are along the lines x = 0 , y = 0 and 4x + 5y = 20 is 1

a) none of these
b) a)10
c) 1/10
d) 20

92. If (x , y) are the coordinates of point in the plane , then $\begin{vmatrix} 3 & 4 & 2 \\ 5 & 8 & 2 \\ x & y & 2 \end{vmatrix} = 0$ represents

a) a straight line parallel to x axis
b) a straight line
c) a circle
d) none of these

93. The locus of a point, whose abscissa and ordinate are always equal is **1**

a) x – y = 0 b) x + y + 1 = 0
c) x + y = 1 d) none of these.

94. Given the three straight lines with equations 5x + 4y = 0, x + 2y – 10 = 0 and 2x + y + 5 = 0, then these lines are **1**

a) the sides of an equilateral triangle b) none of these
c) the sides of a right angled triangle d) concurrent

95. The orthogonal projection of the point (2 , - 3) on the line x + y = 0 is **1**

a) (2 , - 3) b) (2 , 3)
c) (-2 , -3) d) (5/2 , - 5/2)

96. The number of lines that are parallel to 2x + 6y – 7 = 0 and have an intercept 10 units between the coordinate axis is : **1**

a) none of these b) 2
c) 4 d) 1

97. The angle between the two straight lines $6y^2 - xy - x^2 + 30y + 36 = 0$ is **1**

a) 30^0 b) none of these
c) 45^0 d) 60^0

98. The distance between the parallel lines $x^2 + 2xy + y^2 - 6x - 6y + 8 = 0$ is **1**

a) 2 b) 1
c) $\sqrt{2}$ d) none of these

99. The points (- a , - b) , (0 , 0) , (a , b) and $a^2, ab)$ are **1**

a) collinear b) vertices of a square
c) vertices of a rectangle d) vertices of a parallelogram

100. Three points A , B and C are collinear if the area of triangle ABC is **1**

a) none of these b) zero
c) less than zero d) greater than zero

101. The locus of a point which moves so that its distance from a fixed point, called focus, bears a constant ratio, which is less than unity, to its distance from a fixed line, called the directrix is called **1**

a) a parabola b) an ellipse
c) a circle d) a hyperbola

102. The centre of a circle passing through the points (0, 0), (1, 0) and touching the circle $^2 + y^2 = 9$ is **1**

a) $\left(\frac{1}{2}, -\sqrt{2}\right)$ b) $\left(\frac{1}{2}, \frac{1}{2}\right)$
c) $\left(\frac{1}{2}, -\sqrt{2}\right)$ d) $\left(\frac{1}{2}, \frac{3}{2}\right)$

103. The length of latus rectum of an ellipse is one-third of its major axis. Its eccentricity would be **1**

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

104. The locus of a variable point whose distance from the point (2, 0) is– times its distance from the line $x = \frac{9}{2}$ is **1**

a) a circle b) a parabola
c) a hyperbola d) an ellipse

105. Parabolas $x^2 = 4y$ and $y^2 = 4x$ intersect **1**

a) on the line x + y = 0 b) on the line y = x
c) none of these d) in a unique point

106. S and T are the foci of an ellipse and B is an end of the minor axis. If STB is an equilateral triangle, the eccentricity of the ellipse is **1**

a) $\frac{1}{2}$ b) $\frac{1}{4}$
c) $\frac{1}{3}$ d) $\frac{2}{3}$

107. The ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, b^2 = a^2$ is a **1**

a) a hyperbola b) none of these.
c) horizontal ellipse d) vertical ellipse

108 $x = \frac{e^t+e^{-t}}{2}, y = \frac{e^t-e^{-t}}{2}; t \in R$ represents 1

a) a circle b) an ellipse
c) a parabola d) a hyperbola

109. A bridge is in the shape of a semi-ellipse. It is 400 meters long and has a maximum height of 10 metres at the middle points. The height of the bridge at a point distant 80 meters from one end is 1

a) 2 metres b) 8 metres
c) 4 metres d) $\sqrt{91}$ metres

110. The eccentricity of $x^2 + 4y^2 = 24$ is 1

a) $\frac{1}{2}$ b) $\frac{1}{4}$
c) $\frac{7}{4}$ d) $\sqrt{\frac{7}{4}}$

111. The number of points on X-axis which are at a distance c units (c<3) from (2, 3) is 1

a) 2 b) 0
c) 1 d) 3

112. The radius of the circle 3 x (x – 2) + 3 y (y + 1) = 4 is 1

a) 3 b) $\sqrt{\frac{15}{4}}$
c) $\sqrt{\frac{31}{12}}$ d) 2

113. The equation of the tangent to the conic $^2 - y^2 - 8x + 2y + 11 = 0$ at (2, 1) is 1

a) 2 x + 1 = 0 b) x – 2 = 0
c) x +2 = 0 d) x + y + 1 = 0

114. In an ellipse the distance between its foci is 6 and its minor axis is 8 ; the eccentricity of the ellipse is 1

a) $\frac{1}{\sqrt{52}}$ b) $\frac{1}{2}$
c) $\frac{3}{5}$ d) $\frac{3}{5}$

115. The straight line 3 x + 4 y = 20 and the circle $x^2 + y^2 = 16$ 1

a) none of these b) intersect in two distinct points
c) neither touch nor intersect in two points d) touch each other

116. The equation of a circle with origin as centre and passing through the vertices of an equilateral triangle whose median is of length 3a is 1

a) $x^2 + y^2 = 16a^2$ b) $x^2 + y^2 = 4a^2$
c) $x^2 + y^2 = 9a^2$ d) $x^2 + y^2 = a^2$

117. The equation $x = at^2, y = 4at$; $t \in R$ represent 1

a) a hyperbola b) a parabola
c) a circle d) an ellipse

118. The graph of the function f(x) $= \frac{1}{x} i.e.$ the curve $y = \frac{1}{x}$ is 1

a) a hyperbola b) a parabola
c) an ellipse d) a circle

119. The equations x = a cos , y = b sin , $0 \leq \theta < 2\pi$, a $\neq$ b, represent 1

a) a parabola b) an ellipse
c) a hyperbola d) a circle

120. The number of tangents to the circle $x^2 + y^2 - 2x + 4y = 0$ through the point (- 1, 2) is 1

a) 2 b) 0
c) 1 d) none of these

Solution

Class 11 - Physics

MCQ NOV 2019-20

Section A

1. (d)
   0, -25.1 J

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

2. (b)
   time dependence

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

3. (c)
   10.36 m/s

   Explanation:
   Mass of troly M = 200Kg
   mass of child m = 20Kg
   speed of trolley v = 36Km/hr=36 x 5/18 = 10m/s
   Let *v'* be the final velocity of the trolley with respect to the ground.
   Final velocity of the boy with respect to the ground = $v' - 4$
   from conservation of linear momentum
   $p_i = p_f$
   $(M + m)\, v = Mv' + m\,(v' - 4)$
   $(200 + 20) \times 10 = 200v' + 20\,(v' - 4)$
   $2200 = 220v' - 80$
   $v' = \dfrac{2280}{220} = 10.36m/s$

4. (b)
   work done on it by the net force

   Explanation:
   if a body of mass m move with velocity u under the action of force F. Its velocity become v after displaced by s. then
   $v^2 = u^2 + 2as$
   $v^2 - u^2 = 2as$
   $mv^2 - mu^2 = 2mas$
   $\dfrac{1}{2}mv^2 - \dfrac{1}{2}mu^2 = Fs$
   $K_f - K_i = W$
   $\Delta K = W$

5. (d)
953 N/m

Explanation:
Potential energy of spring converted in to potential energy
$\frac{1}{2}kx^2 = mgh$
$k = \frac{2mgh}{x^2} = \frac{2 \times 35 \times 10^{-3} \times 9.8 \times 20}{0.12 \times 0.12} = 953 N/m$

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

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

7. (c)
8.82 J

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

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

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

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

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

10. (b)
3.77 $\times 10^{26}$ W

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

11. (d)
the axis of rotation moves

Explanation:
As precession is a change in the orientation of the rotational axis of a rotating body, so the orientation of axis of rotation of Top change

12. (b)
1.0 m/s

Explanation:
$K_{rot} = \frac{1}{2}I\omega^2$
$K_{trans} = \frac{1}{2}mv^2$
given that
$K_{rot} = K_{trans}$
$\frac{1}{2}I\omega^2 = \frac{1}{2}mv^2$
$I = 3Kgm^2$
$\omega = 3rad/s$
$m = 27Kg$
$v = ?$
$I\omega^2 = mv^2$
$v = \sqrt{\frac{I\omega^2}{m}} = \sqrt{\frac{3 \times 3 \times 3}{27}} = 1.0m/s$

13. (b)
6 hrs

Explanation:
As the Moment of inertia of earth considered as sphere is I = 2/5 MR^2 , thus according to law of conservation of angular momentum as the radius contracts to half , thus new moment of inertia of earth will be I/4 , thus the angular velocity will increase 4 times and making the length of the day to 6 hrs.

14. (d)
Ring of mass M and radius R about an axis perpendicular to its plane

Explanation:
$I_{Ring} = MR^2$
$I_{disc} = \frac{1}{2}MR^2$
$I_{sphere} = \frac{2}{5}MR^2$
$I_{rod} = \frac{MR^2}{12}$
Hence ring has largest moment of inertia.

15. (b)
it is 4: 1

Explanation:
$I_1\omega_1 = I_2\omega_2$
$\frac{I_1}{I_2} = \frac{\omega_2}{\omega_1}$
$\omega_1 = 1rev/s$
$\omega_2 = 16rev/s$
if radius of gyration is k_1 and k_2 then

$$\frac{Mk_1{}^2}{Mk_2{}^2} = \frac{\omega_2}{\omega_1}$$

$$\frac{k_1}{k_2} = \sqrt{\frac{\omega_2}{\omega_1}} = \sqrt{\frac{16}{1}} = \frac{4}{1}$$

$$k_1 : k_2 = 4 : 1$$

16. (d)
$\frac{M}{M+4m} \cdot \omega$

Explanation:
Let ω be the angular velocity of the Ring of Mass M , thus the moment of inetia about given axis is I_1 = MR^2 and the four point objects are genlty placed at perpendicular diameters at opposite end, so thus the distance of each object from axis of rotation is R, so total moment of inetia of ring and four objects is I_2 = $MR^2 + 4mR^2$.
According to law of conservation of angular momentum $I_1 \omega = I_2\omega_2$, So on solving $\omega_2 = \left(\frac{MR^2}{MR^2+4mR^2}\right)\omega$= $\frac{M}{M+4m} \cdot \omega$

17. (a)
L/4

Explanation:
$$K = \frac{1}{2}I\omega^2 = \frac{1}{2} \times I\omega \times \omega$$

$$K = \frac{1}{2}L\omega$$

$$\frac{K_1}{K_2} = \frac{L_1\omega_1}{L_2\omega_2}$$

$K_1 = K$, $K_2 = K/2$

$n_1 = n$, $\omega_1 = 2\pi n = \omega$

$n2 = 2n$, $\omega_2 = 2\pi \times 2n = 2\omega$

$L_1 = L$, $L_2 = ?$

$$\frac{2K}{K} = \frac{L\omega}{L_2 \times 2\omega}$$

$$L_2 = \frac{L}{4}$$

18. (a)
$\frac{Ml^2\omega}{3t}$

Explanation:
As Torque(τ) is equal to product of Moment of Inertia (I) and Angular acceleration (α)

$$\tau = I\alpha$$

$$\tau = I\frac{\Delta\omega}{\Delta t}$$

$$\tau = \left[\frac{M(2l)^2}{12}\right]\left[\frac{\omega}{t}\right]$$

$$\tau = \frac{Ml^2\omega}{3t}$$

19. (a)
$\frac{176}{105}\rho R^5$

Explanation:

$I = \frac{2}{5}\left(MR^2\right)$

$= \frac{2}{5}[(\frac{4}{3}\pi R^3).\rho.R^2]$ As Mass = Density x Volume of Sphere

$= \frac{2}{5}[(\frac{4}{3}\frac{22}{7}R^3).\rho.R^2]$

$= \frac{176}{105}\rho R^5$

20. (a)

$\frac{100}{\sqrt{3}}$

Explanation:

Moment of inertia of rod about an axis passing through its centre of gravity and perpendicular to its length

$I = \frac{Ml^2}{3}$

Moment of inertia of rod in terms of radius of gyration

$I = Mk^2$

$M = 100gm$

$l = 100cm$

$Mk^2 = \frac{Ml^2}{3}$

$k = \sqrt{\frac{l^2}{3}} = \sqrt{\frac{100 \times 100}{3}}$

$k = \frac{100}{\sqrt{3}}cm$

21. (a)

108 rad

Explanation:

$\omega = \omega_o + \alpha t$

$36 = 0 + 6\alpha$

$\alpha = \frac{36}{6} = 6rad/s^2$

$\theta = \omega_o t + \frac{1}{2}\alpha t^2$

$\theta = 0 + \frac{1}{2} \times 6 \times 6 \times 6$

$\theta = 108rad$

22. (a)

at any instant of time every particle of the body has the same velocity.

Explanation:

In translational motion when the body moves along a straight line or more exactly when every point of the body travels on paralell lines, thus at any instant of time every particle of the body has the same velocity.

23. (a)

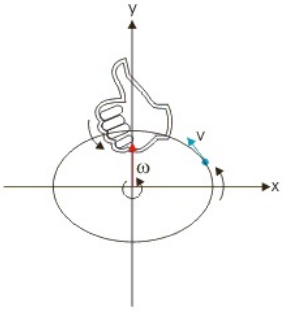
Angular momentum

Explanation:

According to law of conservation of angular momentum if no external torque is applied on a body in rotation than its angular momentum remains conserved.

24. (c)
At right angles to the plane of paper.

Explanation:
Angular acceleration is an axial vector. It is always directed along axis of rotation according to right hand screw rule. Hence direction of the angular acceleration vector is perpendicular to the plane in which the rotation takes place.



25. (b)
1.04 kg metre^2

Explanation:
I = I_1 + I_2 + I_3 + I_4
$I = m_1r_1^2 + m_2r_2^2 + m_3r_3^2 + m_4r_4^2$
$I = (2 \times 0.4 \times 0.4) + (5 \times 0.2 \times 0.2) + (5 \times 0.2 \times 0.2) + (2 \times 0.4 \times 0.4)$
I = 0.32 + 0.20 + 0.20 + 0.32
I = 1.04 K gm^2

26. (c)
remains constant

Explanation:
As angular momentum is $\vec{L} = \vec{p} \times \vec{r} = mvrsin\theta$, Now rsinθ=perpendicular distance from x axis which is constant, so angular momentum is remains constant.

27. (d)
$R = \frac{\sum m_i.r_i}{\sum m_i}$

Explanation:
Let us consider a system consisting of N – particles of masses m_1 , m_2,..... m_N having position vectors $\vec{r}_1, \vec{r}_2, ...\vec{r}_N$ respectively.
The total mass M of the system is given by
M = m_1 +m_2 +.....+ m_N
We can generalize the definition of position of centre of mass consisting of N particles , hence the position vector of centre of mass is given below:-

$$\vec{R} = \frac{m_1\vec{r}_1+m_2\vec{r}_2+.....+m_N\vec{r}_N}{m_1+m_2+.....+m_N} = \frac{\sum\limits_{i=1}^{N} m_i\vec{r}_i}{\sum\limits_{i=1}^{N} m_i} = \frac{\sum\limits_{i=1}^{N} m_i\vec{r}_i}{M}$$

28. (b)
mr^2 ω^2 /2

Explanation:

The kinetic energy of body in rotational motion is $KE = \frac{1}{2}I\omega^2 = \frac{1}{2}mr^2\omega^2$ as moment of inertia of ring about its central axis is I = mr^2

29. (a)
the product of the total mass of the system and the velocity of its centre of mass

Explanation:

Let us consider a system of n particles of masses m_1 , m_2 , ...m_N. If M is the total mass of the system .
M = m_1 + m_2 +.....+ m_N
If $\vec{R}$ is the position vector of the centre of mass and $\vec{r}_1, \vec{r}_2, \vec{r}_3 \ldots\ldots \vec{r}_n$ those of constituent particles then
$\vec{R} = \frac{m_1\vec{r}_1+m_2\vec{r}_2+....+m_N\vec{r}_N}{m_1+m_2+.....+m_N} = \frac{m_1\vec{r}_1+m_2\vec{r}_2+m_N\vec{r}_N}{M}$
Differentiating both sides w.r.t. time t,we get
$\frac{d\vec{R}}{dt} = \frac{1}{M}\left[m_1\frac{d\vec{r}_1}{dt} + m_2\frac{d\vec{r}_2}{dt} + \ldots\ldots\ldots + m_N\frac{d\vec{r}_N}{dt}\right]$
Let the velocity of centre of mass is $\frac{d\vec{R}}{dt} = \overrightarrow{V_{CM}}$
$\frac{d\overrightarrow{r_1}}{dt} = \vec{v}_1, \frac{d\overrightarrow{r_2}}{dt} = \vec{v}_2 \ldots\ldots \frac{d\overrightarrow{r_n}}{dt} = \overrightarrow{v_n}$
$M\overrightarrow{V_{CM}} = m_1\vec{v}_1 + m_2\vec{v}_2 + \ldots + m_N\vec{v}_N = \sum_{i=1}^{N} m_i\ \vec{v}_i$
Hence the total momentum of a system of particles is equal to the product of the total mass of the system and the velocity of its centre of mass.

30. (b)
his moment of inertia decreases

Explanation:
When gymnast lowers his hand the distance of mass from rotational axis decrease. Hence his moment of inertia decreases and angular velocity increase to conserve angular momentum.

31. (d)
$\sqrt{(3)} : \sqrt{(5)}$

Explanation:
Moment of inertia of hollow sphere about an axis passing through its diameter
$I_1 = \frac{2}{3}M{R_1}^2$
Moment of inertia of hollow shell about an axis passing through its diameter
$I_2 = \frac{2}{5}M{R_2}^2$
Given that
$I_1 = I_2$
$\frac{2}{3}M{R_1}^2 = \frac{2}{5}M{R_2}^2$
$\frac{R_1}{R_2} = \sqrt{\frac{3}{5}}$
$R_1 : R_2 = \sqrt{3} : \sqrt{5}$

32. (d)
$|\mathbf{a}|\,|\mathbf{b}|\sin\theta$

Explanation:
As per definition of vector product :-
$\vec{c} = \vec{a} \times \vec{b} = |\vec{a}|\left|\vec{b}\right|\sin\theta\hat{n}$

$|\vec{c}| = |\vec{a}|\left|\vec{b}\right|\sin\theta$

33. (c)
1.33×10^5 m/sec

Explanation:
Perihelion is the nearest distance of planet from focus.
aphelion is the farthest distance of planet from focus.
$v_p = 2 \times 10^7 m/s$
$v_a = ?$
$r_p = 2 \times 10^{10} m$
$r_a = 3 \times 10^{12} m$
$\frac{v_p}{v_a} = \frac{r_a}{r_p}$
$\frac{2 \times 10^7}{v_a} = \frac{3 \times 10^{12}}{2 \times 10^{10}}$
$v_a = 1.33 \times 10^5 m/s$

34. (a)
72

Explanation:
$n = \frac{720}{60} = 12$ rev/s
angular velocity $\omega = 2\pi n = 2\pi \times 12 = 24\pi$ rad/s
moment of inertia
I = $\frac{24}{\pi}$ kg m^2
torque
$T = I\alpha$
$T = I\frac{\Delta\omega}{\Delta t} = \frac{24}{\pi} \times \left(\frac{24-0}{8}\right) = \frac{24}{\pi} \times \frac{24\pi}{8} = 72.0 Nm$

35. (a)
every particle of the body moves in a circle, which lies in a plane perpendicular to the axis and has its centre on the axis

Explanation:
When a rigid body rotates about a fixed axis, all particles of the body except those which lies on the axis of rotation, move along circular paths in a plane perpendicular to the axis.

36. (c)
it is 2 : 1

Explanation:
$\frac{M_1}{M_2} = \frac{1}{2}$
$\frac{R_1}{R_2} = \frac{2}{1}$
$\frac{I_1}{I_2} = \frac{M_1 {R_1}^2}{M_2 {R_2}^2}$
$\frac{I_1}{I_2} = \left(\frac{M_1}{M_2}\right)\left(\frac{R_1}{R_2}\right)^2 = \frac{1}{2} \times \left(\frac{2}{1}\right)^2 = \frac{1}{2} \times \frac{4}{1} = \frac{2}{1}$
$I_1 : I_2 = 2 : 1$

37. (c)
it is 5:1

Explanation:
$I_1\omega_1 = I_2\omega_2$
$\frac{I_1}{I_2} = \frac{\omega_2}{\omega_1}$
$\omega_1 = 1rev/s$
$\omega_2 = 25rev/s$
if radius of gyration is k_1 and k_2 then
$\frac{M{k_1}^2}{M{k_2}^2} = \frac{\omega_2}{\omega_1}$
$\frac{k_1}{k_2} = \sqrt{\frac{\omega_2}{\omega_1}} = \sqrt{\frac{25}{1}} = \frac{5}{1}$
$k_1 : k_2 = 5 : 1$

38. (c)
0.3 π kg $\times$ m^2 / sec

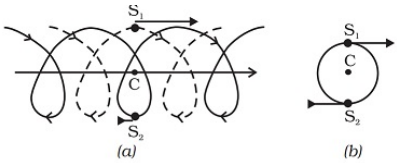
Explanation:
n = 0.5 revolution per second
angular velocity $\omega = 2\pi n = 2\pi \times 0.5 = \pi rad/s$
moment of inertia $I = 0.3Kgm^2$
angular momentum $L = I\omega = 0.3 \times \pi = 0.3\pi Kgm^2/s$

39. (d)
$\sqrt{(}\omega_2) : \sqrt{(}\omega_1)$

Explanation:
$I_1\omega_1 = I_2\omega_2$
$\frac{I_1}{I_2} = \frac{\omega_2}{\omega_1}$
$\frac{m{k_1}^2}{m{k_2}^2} = \frac{\omega_2}{\omega_1}$
$\frac{k_1}{k_2} = \sqrt{\frac{\omega_2}{\omega_1}}$
$k_1 : k_2 = \sqrt{\omega_2} : \sqrt{\omega_1}$

40. (a)
i. uniform motion in a straight line of the centre of mass and
ii. circular orbits of the stars about the centre of mass

Explanation:
A double star or visual double is a pair of stars that appear close to each other in the sky as seen from Earth when viewed through an optical telescope.
In absence of external force Centre of mass of double star moves like a free particle. In Centre of mass frame both stars moving in a circle about the Centre of mass which is at rest and both star are diametrically opposite to each other.
Thus in our frame of reference, the trajectories of the stars are a combination of
i. uniform motion in a straight line of the Centre of mass and
ii. circular orbits of the stars about the Centre of mass.



a. Trajectories of two stars, S_1 (dotted line) and S_2 (solid line) forming a binary system with their centre of mass C in uniform motion.
b. The same binary system, with the centre of mass C at rest.

Solution

Class 11 - Chemistry

Multiple Choice Questions Examination

Section A

41. (b)
Both CuS and ZnS precipitate

Explanation:
Precipitation occurs only when ionic product exceeds the value of solubility product.
1 dm^3 of the solution containing 0.1 mole of Zn^{2+}, 0.01 mole of Cu^{2+} and 8.1 x 10^{-39} mole of S^{2-} .
Let us calculate the ionic product in each case.
Ionic product of ZnS = [Zn^{2+}] [S^{2-}]
$0.1 \times 8.1 \times 10^{-19} = 8.1 \times 10^{-20}$
K_{sp} of ZnS $= 3 \times 10^{-22}$
Here, Ionic Product > K_{sp}
Ionic Product of CuS = [Cu^{2+}] [S^{2-}]
$= 0.01 \times 8.1 \times 10^{-19} = 8.1 \times 10^{-21}$
But it has $K_w = 8 \times 10^{-36}$
Since, Ionic product > K_{sp}
As both ZnS and CuS have less K_{sp} value than their ionic product so ZnS and CuS both get precipitated.

42. (d)
$1.8 \times 10^{-3} \text{L mol}^{-1}$

Explanation:
Kc = [PCl3] [Cl2] / [PCl5] = 1.2 x 10^{-3} x 1.2 x 10^{-3} / 0.8 x 10^{-3} = 1.8 x 10^{-3} L mol^{-1}

43. (a)
increasing the total pressure

Explanation:
The equilibrium reaction for dissociation of H_2 into H atoms is as follows:$H_2 \rightleftharpoons H+H$.
Since, number of atoms on reactant side and product side are same, therefore, change in pressure have no effect on position of equlibrium.

44. (b)
increase

Explanation:
1. Pressure will increase in the forwarded reaction and the number of moles of the products increase.
2. Pressure will increase in the backward reaction and the number of moles of the products decrease.
3. The change in pressure will have no effect on the equilibrium constant and there will be no change in the no. of moles.

45. (d)
10^{-5} M

Explanation:
$BaSO_4 \rightarrow Ba^{2+} + SO_4^{2-}$
$K_{sp} = [Ba^{+2}] [SO_4^{-2}]$
$K_{sp} = x^2 = 10^{-10}$
$x^2 = 10^{-10}$
$x = 10^{-5}$

46. (d)
$\Delta H > 0$ for the reaction

Explanation:
FOR AN ENDOTHERMIC REACTION - IF TEMPERATURE IS DECREASED REACTION WILL SHIFT TO BACKWARD DIRECTION

$[Co(H2O)\ 6\ ]^{3+}$ (aq) + $4Cl^-$ (aq)⇌ $[CoCl4\ ]^{2-}$(aq) + $6H_2O$(l)

pink colourless blue

At room temperature, the equilibrium mixture is blue due to $[CoCl\ 4\ ]^{2-}$. When cooled in a freezing mixture, the colour of the mixture turns pink due to $[Co(H2O)6\ ]^{3+}$.

47. (b)
5×10^{-7}

Explanation:
pH + pOH = 14
pOH = 14 - 12 = 2
pOH = -log[OH^-]
OH^- = $10^{-\ pOH}$ = $10^{-\ 2}$ ..... (1)
At equilibrium $Ba(OH)_2 = Ba^{+2} + 2OH^-$
let [OH^-] = x , therefore, From above equation; 2[OH^-] = 2x = $10^{-\ 2}$ (from equation 1)
Therefore $x = \frac{10^{-2}}{2} = 0.5 \times 10^{-2}$
K_{sp} = [Ba^{+2}] [OH^-]^2 = $[0.5 \times 10^{-2}][10^{-2}]^2 = 0.5 \times 10^{-6} = 5 \times 10^{-7}$

48. (a)
Lewis concept

Explanation:
GN lewis in 1923 defined an acid as a species which accepts an electron pair and base which donates an electron pair.
as BF3 is a electron deficient compounds, hence it is a lewis acid.
BF_3 does not have a proton but still acts as an acid and reacts with NH_3 by accepting its lone pair of electrons.
The reaction can be represented by,
BF_3 + :NH_3→ BF_3 :NH_3

49. (a)
K < 1

Explanation:
$\Delta G0 = -RTlnK$
• If $\Delta G0 > 0$, then $-\Delta G0/RT$ is negative, and $e-\Delta G0/RT < 1$, that is , $K < 1$, which implies a non-spontaneous reaction or a reaction which proceeds in the forward direction to such a small degree that only a very minute quantity of product is formed.

50. (a)
nothing appears to happen, but forward and reverse are continuing at the same rate

Explanation:
3. Q=K,
The reaction is already at equilibrium. The concentrations won't change since the rates of the forward and backward reactions are equal.

51. (c)
$4.17 \times 10^{-8}\ M$

Explanation:
pH = -log[H^+]
7.38 = -log[H^+]
$\log[H^+] = -7.38 = \bar{8}.62$
Taking antilog on both sides, we get
[H^+] = 4.17×10^{-8}

52. (d)
$108y^5$

Explanation:
$\underset{y}{Ca_3}(PO_4)_2 = \underset{3y}{3Ca^{2+}} + \underset{2y}{2PO_4^{3-}}$
solubility product = $K_{sp} = [Ca^{2+}]^3[PO_4^{3-}]^2 = (3y)^3\ (2y)^2 = 108y^5$

53. (b)
2.0

Explanation:
Δn_{gas} = 2 = $n_{gas}(\text{Product})$ - $n_{gas}(reactant)$

54. (b)
HCl, Cl^- and H_2O, H_3O^+ .

Explanation:
A species formed by receiving a proton from a base is known as conjugate acid and Conjugate base is a species formed by the removal of proton from an acid.
In this case, Cl^- is formed by donating a proton to water molecule hence it is a conjugate base while protonated water (H_3O^+)becomes conjugate acid.

55. (c)
1 + x

Explanation:
$N_2O_4 \rightleftharpoons 2NO_2$

t = 0	1	0
t = t	1 - x	2x

total moles at eqm(t = t) = 1 - x + 2x = 1+ x

56. (c)
Aqueous ammonia solution

Explanation:
AgCl is soluble in ammonia due to the formation of complex $[Ag(NH_3)_2]^+Cl^-$

57. (a)
BF_3 acts as Lewis acid and coordinate bond is formed.

Explanation:
BF_3 is an electron deficient compound . Hence, it act as Lewis acid. NH_3 has a lone pair of electrons. Hence, acts as Lewis base. A coordinate bond is formed between the two, as nitrogen atom of ammonia acts as electron donor, while B of BF_3 acts as electron acceptor.$H_3N: \rightarrow BF_3$

58. (c)
$[Ag^+]^2[CrO_4^{2-}]$

Explanation:

$Ag_2CrO_4 \rightarrow\ 2\ Ag^+\ +\ CrO_4^{2-}$
$suppose\ solubility\ is\ 's'\ \ then\ K_{SP}\ =\ [2\ s]^2[\ s]\ =\ 4\ s^3$

59. (c)
$RO^- > OH^- > CH_3COO^- > Cl^-$

Explanation:

conjugate acids of given bases are H_2O, ROH, CH_3COO^-, Cl^-

their acidic strength in the order

Cl^- > CH_3COO^- > H_2O > ROH

basic strength in the order RO^- > OH^- > CH_3COO^- > Cl^-

60. (c)
11.31

Explanation:
$KOH \rightarrow\ K^+\ + OH^-\qquad (As\ KOH\ undergoes\ complete\ ionization)$
$\Rightarrow\ [OH^-]\ = [KOH] =\ 0.02$
$We\ know\ that,\ K_w\ = [H^+]\ [OH^-]\ \Rightarrow [H^+] = \frac{K_w}{[OH^-]} = \frac{10^{-14}}{0.02} =\ 5 \times 10^{-12}$
$\Rightarrow pH =\ -\log[5 \times 10^{-12}]\ = 12 - \log 5 = 12 - 0.699 \approx 11.30$

61. (b)
3.4

Explanation:
Acetic acid is a weak acid with $K_a = 1.74 \times 10^{-5}$ and in this case cweak acid >>> K_0,
that is the equation to use is: $[H^+]$ = (Ka.Cweakacid)$^{1/2} = (1.7 \times 10^{-5} \times 0.01)^{1/2} = 4.3 \times 10^{-4}$
$pH = -\log[H^+] = -\log(4.3 \times 10^{-4}) = -[\log 4.3 + (-4)\log 10]$ = -[0.633-4] = 3.367

62. (d)
$K_1^2 = \frac{1}{K_2}$

Explanation:
Here, $K_1 = \frac{[SO_3\ (g)]}{[O_2(g)]^{1/2}[SO_2(g)]}$ .....(1)
$K_2 = \frac{[SO_2\ (g)]^2[O_2(g)]}{[SO_3(g)]^2}$ ..... (2)
square the equation(1) and equal the eq(1) and (2), we get: $K_2 = 1/(K_1)^2$

63. (b)
$2.5 \times 10^{-3}\ M, 2.5 \times 10^{-3}\ M\ ,\ 17.6 \times 10^{-3},\ 2.62$

Explanation:

$$\begin{array}{lccc} & HF \rightleftharpoons & H^+ + & F^- \\ Initial\ Concentration; & 1 & 0 & 0 \\ Equilibrium\ concentration; & C(1-\alpha) & C\alpha & C\alpha \end{array}$$

$Now,\ K_a\ = \frac{[H^+]\,[F^-]}{[HF]} = \frac{[\ C\alpha][\ C\alpha]}{[C(1-\alpha)\ ]} = \frac{C\alpha^2}{(1-\alpha)} \approx C\alpha^2 \qquad (Since\ \alpha\ is\ less,\ (1-\ \alpha)\ can\ be\ written\ as\ 1)$
$\Rightarrow \alpha = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{3.2 \times 10^{-4}}{0.02}} = 12.65 \times 10^{-2}$
$[H^+] = C\alpha = 0.02 \times 0.1265\ = 2.53 \times 10^{-3}$
$[F^-] = C\alpha = 0.02 \times 0.1265\ = 2.53 \times 10^{-3}$
$[HF] = C(1-\alpha) = 0.02 \times (1 - 0.1265)\ = 1.7 \times 10^{-2}$
Now,
$pH =\ -\log[H_3O^+] = -\log\ (2.53 \times 10^{-3})\ = 3 - 0.4031 = 2.5969$

64. (c)
Normal melting point and Freezing point

Explanation:
These are normal melting point and freezing point since they are measured at atmospheric pressure.

65. (a)
Less than 7.0

Explanation:
pH of water will be less 7 only. Water will be acidic even at 60°C

66. (a)
Ag and Fe^{3+}

Explanation:
$2Ag \rightarrow 2Ag^{+1} + 2e^-$ E^o = – 0.80 V
$2Fe^{3+} + 2e^- \rightarrow 2Fe^{+2}$ E^o = +0.77 V
On adding the values we get,
$E^0_{cell} = -0.03V$
E°cell is the electromotive force (also called cell voltage or cell potential) between two half-cells. The greater the E°cell of a reaction the greater the driving force of electrons through the system, the more likely the reaction will proceed. Thus, reaction will not proceed as standard cell potential is less than zero.

67. (a)
$I_2 < Br_2 < Cl_2 < F_2$

Explanation:
Halogens have high electronegativity and electron affinity. They have greater tendency to accept electrons or easily reduced, therefore they are strong oxidizing agent.
As the reduction potential decrease down the group,the oxidizing power decrease down the group the order of the oxidizing power will be as under
F2 > Cl2> Br2> I2
¥ The oxidizing power depends on,
Heat of dissociation of halogen molecule.
Electron affinity of atom.
Hydration energy of the ion.
Heat of vaporization
If a halogen has low energy of dissociation, a high electron affinity, and higher hydration of its ion, it will have high oxidizing power.
F has although low electron affinity than Cl but low dissociation energy and have high hydration energy of its ion, therefore Fluorine is strongest oxidizing agent.

68. (b)
$3d^2 4s^2$

Explanation:
($3d^2 4s^2$) is the configuration of transition element which shows variable oxidation state.

69. (d)
charge on the ion

Explanation:
By definition, the **oxidation number** of an atom is the charge that atom would have if the compound was composed of ions.
The oxidation number of simple ions is equal to the charge on the ion. The oxidation number of sodium in the Na^+ ion is +1, for example, and the oxidation number of chlorine in the Cl^- ion is -1.

70. (b)
disproportionation reaction

Explanation:
$\underset{+1}{2H_2}\underset{-1}{O_2}(aq) \rightarrow \underset{+1}{2H_2}\underset{-2}{O} + \underset{0}{O_2}$
Here the oxygen of peroxide, which is present in -1 state, is converted to zero oxidation state in O_2 and decreases to -2 oxidation state in H_2O.

71. (b)
F

Explanation:
Flourine is most electronegative element.

72. (d)
4

Explanation:
4

73. (b)
F

Explanation:
Fluorine is more electronegative as it belongs to group 17 or 7 and can show only negative oxidation state of –1.

74. (c)
Ca, which acts as reducing agent

Explanation:
Calcium is a silvery-white metal; it is relatively soft, but much harder than sodium metal. Calcium is a member of the alkaline-earth metals (Group II on the periodic table); these metals react vigorously with water, although not as violently as the Group I metals such as sodium or potassium:
$Ca(s) + 2H_2O(l) \longrightarrow Ca(OH)_2(aq) + H_2(g)$

75. (c)
zero

Explanation:
In free or uncombined state each element has zero oxidation state.

76. (d)
Oxygen is oxidised as well as reduced

Explanation:
This is a dispropotionation reaction.(Disproportionation is a specific type of redox reaction in which an element from a reaction undergoes both oxidation and reduction to form two different products)

77. (b)
F

Explanation:
F (Fluorine) is most electronegative element so it always show -1 oxidation state.

78. (d)
Phosphorus is undergoing oxidation as well as reduction.

Explanation:
$\underset{0}{P_4} + 3OH^- \rightarrow \underset{-3}{PH_3} + 3H_2\underset{+1}{PO_2^-}$
Phosphorus is undergoing oxidation as well as reduction. As oxidation number of P is 0 in reactant and in product it is -3 as well as +1.

79. (c)
sodium is oxidised and hydrogen is reduced

Explanation:
Oxidation is a process in which one or more electrons are lost and oxidation number is increased. Sodium has 0 oxidation state as reactant and +1 oxidation state as product.
Similarly, Reduction is a process in which one or more electrons are gained and oxidation number is reduced i.e. from +1 to 0.

80. (a)
all alkaline earth metals

Explanation:
Alkaline earth metals have in common an outer s- electron shell which is full; that is, that is why orbital contains its full complement of two electrons, which these elements readily lose to form cations with charge +2, and an oxidation state (oxidation number) of +2.

Solution

Class 11 - Mathematics

Multiple Choice Questions Examination

Section A

81. (b)
- 1

Explanation:
Let us take the coordinates as (-4,3), (2,-3) and (0,p).
If the points are collienear the $\frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1-y_2)| = 0$
Now substituting the values $|-4(-3 - p) +2(p -3) +0(3+3)| = 0$
12 +4p +2p -6 +0 = 0
6p +6 = 0
6p = -6
Therefore p = -1

82. (d)
(3a , - 2b)

Explanation:
The slope of the line joining the points (a,0) and (0,b) is [b-0]/[0-a] = -(b/a)
Hence the equation of the line is y = (-b/a)x +b
i.e; ay = -bx +ab
Substituting the x coordinate 3a in the place of x in the above equation we get y = -2b
Hence (3a,-2b) is another point on the line.

83. (c)
x – 1 = 0 , y – 1 = 0

Explanation:
If the lines make equal angles of 45^0 with the given line, x+y =0.
Then these lines must be perpendicular with each other.
This is possible only when the two lines are parallel to X axis and Y axis.
That is the equations should be x = a constant and y = a constant.
Since it passes through (1,1)
The equations should be x = 1 or x-1=0 and y=1 or y-1 =0

84. (b)
(1 , - 2)

Explanation:
Since a,b,c are in A.P,
a+c = 2b
This implies a-2b+c = 0
This implies the the family of lines is concurrent at (1,2)

85. (b)
25/16

Explanation:
The equation of the line joining the two points (x_1,y_1) and (x_2,y_2) is
$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$
The given points are (1,1,) and (2,0)

On substituting the values we get

8Type your text $\frac{y-1}{0-1} = \frac{x-1}{2-1}$

On simplifying we get,

x+y-2=0

The line which is perpendicular to this line is x-y+k=0

Since it passes through (1/2,0)

(1/2) -0=k

This implies k= -1/2

Hence the equation of this line is x-y-1/2 = 0

On solving these twolines we get the point of intersection as (5/4,3/4)

The point which line x+y-2=0 cuts the Y axis is (0,2) and the point which the line x-y-1/2=0 cuts the Y axis is (0,-1/2)

Hend e the area of the triangle = [1/2]x[5/4]x[5/4] = 25/16 squnits

86. (b)

3/10

Explanation:

Distance between two parallel lies is give by $\frac{|c_1-c_2|}{\sqrt{A^2+B^2}}$

The given lines are parallel where c_1 = 9 and c_2 = 15/2

Sustituting the values

d = $\frac{|9-15/2|}{\sqrt{9+16}}$ = 3/10

87. (b)

isosceles

Explanation:

On solving lines 1 and 2 we get the point of intersection as (-2,2)

On solving the lines 2 and 3 we get, the point of intersection as (2,-2)

On solving lines 3 and 1 we get the point of intersection as (1,1)

Now using distance formula we get AB = $\sqrt{(2-(-2))^2+(-2-2)^2}$ = $\sqrt{8}$

Similarly BC = $\sqrt{(1-2)^2+(1-(-2))^2}$ = $\sqrt{10}$

Similarly AC = $\sqrt{(-2-1)^2+(2-1)^2}$ = $\sqrt{10}$

Since AB = AC, it is an isosceles triangle.

88. (c)

less than 60^0

Explanation:

The angle between two straight lines is given by $\frac{|m_1-m_2|}{1+m_1m_2}$

Here m_1 = 2 and m_2 = -2

Sustituting the values we get,

$tan\theta$ = $\frac{2-(-2)}{1+2.(-2)}$

= 4/5 <60^0

89. (b)

it is 4:9

Explanation:

Let the line divide in the ratio k:1

By applying section formula $\frac{k.x_2-1.x_1}{k+1}$, $\frac{k.y_2-1.y_1}{k+1}$

Sustituting the values

$\frac{-2k+1}{k+1}, \frac{k+2}{k+1}$
This given line 3x+4y=7 passes through this point.
Hence 3($\frac{-2k+1}{k+1}$) + 4($\frac{k+2}{k+1}$)= 7
On simplifying we get
k = 4/9
Hence the ratio is 4:9

90. (d)
(0 , 5)

Explanation:
Let (0,y) be the point on Y axis which is equidistant from the points (-1,2) and (3,4)
By applying the distance formula,
$(0+1)^2 + (y-2)^2 = (3-0)^2 + (4-y)^2$
on simplifying we get
4y = 20
Therefore y = 5
Hence the point on the y axis is (0,5)

91. (b)
a)10

Explanation:
The equation 4x + 5y = 20 can be written as $\frac{x}{5}+\frac{y}{4}$ = 1
This implies the intercepts cut by this line on the X and Y axes are 5 and 4 respectively.
Hence the area of the triangle is 1/2 [5 x 4] = 10 square units

92. (b)
a straight line

Explanation:
The given determinant can be written as $2\begin{vmatrix} 3 & 4 & 1 \\ 5 & 8 & 1 \\ x & y & 1 \end{vmatrix}$ = 0
On expansion we get
2[3(8-y) - 4(5 - x) +1(5y - 8x)]
On simplifying the equation 2(- 4x+2y+4) = 0 represents a striaght line.

93. (a)
x – y = 0

Explanation:
The abscissa is equal to the ordinate implies x = y
Hence the locus is x-y=0

94. (d)
concurrent

Explanation:
The lines are said to be concurrent $\begin{vmatrix} 5 & 4 & 0 \\ 1 & 2 & -10 \\ 2 & 1 & 5 \end{vmatrix}$ = 0
On expanding we get
5(10+10) -4(5+20) + 0 = 0
Hence the lines are concurrent

95. (d)

(5/2 , - 5/2)

Explanation:
Equation of the line which perpendicular to the given line is x - y + k = 0
Since this line passes through (2,-3)
2-(-3) + k = 0
This implies k= -5
Hence the equation og the line is x - y =5
On solving the lines x+y=0 and x-y=5, we get the point of intersection as x = 5/2 and y = -5/2
Hence (5/2,-5/2) is the coordinates of orthogonal projection.

96. (b)
2

Explanation:
Thslope of the given line 2x+6y = 7 is -1/3
Hence the line which is parallel to the above line is
y = (-1/3)x+c
That is the y intercept is (0,c) and the x intercept is (3c,0)
Using the distance formula
$d^2 = (0-3c)^2 + (3c-0)^2$
$= 10c^2$
since the distance is 10 is given,
$100 = 10c^2$
therefore c = ± 10
Since two values are possible, two lines can be drawn.

97. (c)
45^0

Explanation:
Consider the equation $-x^2 +xy +6y^2 = 0$ or $x^2 -xy -6y^2 = 0$
On factorizing we get,
(x-3y)(x+2y) = 0
Hence the equation of the pair of straight lines is given by
x-3y+l = 0 and x+2y +m = 0
Hence the slope of these lines are 1/3 and -1/2 respectively.
The angle between the straight lines is given by,
$tan\theta = \frac{m_1-m_2}{1+m_1m_2} = \frac{1/3-(-1/2)}{1+(1/3)(-1/2)} = 1$
Hence the angle is 45^0

98. (c)
$\sqrt{2}$

Explanation:
Consider the equation $x^2 +2xy + y^2 = 0$
On factorizing we get,
(x+y)(x+y) = 0
Hence the equation of the parallel lines is x+y+l = 0 and x+y+m=0
Now equating the coefficents of like terms for x and y with the combined equation
l+m=-6 and lm = 8
l+(8/l) = -6
$l^2 +6l+8 = 0$
on solving we get

l = -4 or l = 2
Therefore m = -2 or 4
Hence the distance between these two parallel lines is
$\frac{|4-2|}{\sqrt{1^2+1^2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$

99. (a)
collinear

Explanation:
consider the points (a,b),(0,0),(-a,-b)
It is clear the (0,0) is the midpoint of (a,b) and (-a,-b)
This implies that these three points are collinear
Now consider the points,
(a,b),(a^2,ab) and (-a,-b)
If three points are collinear then the area if the triangle formed by these points is zero
That is $\frac{1}{2}[x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2) = 0$
Substituting the values
$\frac{1}{2}[a(a+b)+a^2(-b-b)+(-a)(b-ab)]$
on expanding and simplifying we get the value to be zero
Hence these points are collinear.

100. (b)
zero

Explanation:
Only non collinear points can form a triangle. Hence if the three points are collinear a triangle cannot be formed, hence the area of the triangle is zero

101. (b)
an ellipse

Explanation:
For an ellipse e < 1

102. (c)
$\left(\frac{1}{2}, -\sqrt{2}\right)$

Explanation:
Since the circle passes through (0,0) the equation reduces to
c= 0 -----(1)
Since it passes through (1,0),
1 + 2g + c = 0
This implies g = -1/2
Since the circle touches the circle $x^2 + y^2 = 9$, their radii should be equal
$2\sqrt{g^2 + f^2 + c} = 3$
Substituting the values and simplifying we get f = $\pm\sqrt{2}$
Hence the centre is (1/2, $-\sqrt{2}$)

103. (b)
$\sqrt{\frac{2}{3}}$

Explanation:
$2b^2/a^2$ = 2a/3
Hence $\frac{b^2}{a^2}$ = 1/3. Hence e^2 = 1- $\frac{b^2}{a^2}$ = 1 - (1/3) = 2/3

Therefore e = $\sqrt{\frac{2}{3}}$

104. (d)
an ellipse

Explanation:
Let the point be (x,y)
Hence $(x-2)^2 + (y-0)^2 = \frac{2}{3}\frac{(x-9/2)}{\sqrt{1^2}}$
$(x-2)^2 + y^2 = \frac{2}{3}(x - 9/2)$
On simplifying we get the equation of an ellipse

105. (b)
on the line y = x

Explanation:
point of intersection is(0,0) and (4,4). This implies y = x. Hence it intersects the line y = x

106. (a)
$\frac{1}{2}$

Explanation:
s = (ae,0) and T = (-ae,0) and B = (0,b)
Since it is an equilateral triangle, $ST^2 = TB^2$
This implies $4a^2e^2 = a^2e^2 + b^2$
$3a^2e^2 = b^2$
$3a^2e^2 = a^2(1 - e^2)$
$3e^2 = 1 - e^2$
Therefore e = 1/2

107. (b)
none of these.

Explanation:
If $a^2 = b^2$, then the equation becomes $x^2 + y^2 = a^2$ which represents the equation of a circle.

108. (d)
a hyperbola

Explanation:
$x = \frac{e^t+e^{-t}}{2}, y = \frac{e^t-e^{-t}}{2}; t \in R$
Squaring both sides of both the equation ,we get
$x^2 = \frac{(e^t+e^-t)^2}{4}$ and $y^2 = \frac{(e^t-e^-t)}{4}$
Subtracting one equation from another we get
$x^2 - y^2 = 1$ which is nothing but equation of hyperbola

109. (b)
8 metres

Explanation:
a=200, b=10,
put x=200-80=120.
Substituting in the equation of the ellipese $\frac{x^2}{200^2} + \frac{y^2}{10^2} = 1$
$y^2 = 256/16$

therefore y = 8

110. (a)
$\frac{1}{2}$

Explanation:
Given equation is $3x^2 + 4y^2 = 24$
dividing throught by 24 we get,
$\frac{x^2}{8} + \frac{y^2}{6} = 1$
This implies $a^2 = 8$ and $b^2 = 6$
e = $\frac{\sqrt{a^2-b^2}}{a} = \frac{1}{2}$

111. (b)
0

Explanation:
the shortest distance from x-axis to the point is 3.

112. (c)
$\sqrt{\frac{31}{12}}$

Explanation:
The general form of the given circle is $x^2 + y^2$-2x +y - 4/3 = 0
Hence g = 1, f = -1/2 and c = -4/3
Radius = $\sqrt{g^2 + f^2 - c}$
Substituting the values we get,
Radius = $\sqrt{1 + 1/4 + 4/3} = \sqrt{\frac{31}{12}}$

113. (b)
x – 2 = 0

Explanation:
Differentiating the given equation w.r.t x, we get,
2x -2y$\frac{dy}{dx}$ -8 + 2 $\frac{dy}{dx}$ = 0
$\frac{dy}{dx}$(1-y) = x - 4
Therefore $\frac{dy}{dx} = \frac{x-4}{1-y}$
Therefore $\frac{dy}{dx}_{(2,1)}$ is not defined
The equation of the tangent at (x_1, y_1) is $y-y_1 = m(x - x1)$
Therefore the equation of the tangent is x-2 = 0

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

Explanation:
here c=3, b=4, from relation $a^2=b^2+c^2$ we get a=5.
e=c/a = 3/5

115. (d)
touch each other

Explanation:
distance from the origin to the line is equal to the radius.

$\frac{0+0+20}{\sqrt{3^2+4^2}}$ = 4. The radius of the circle is 4.
Hence the line and circle touches each other.

116. (b)
$x^2 + y^2 = 4a^2$

Explanation:
$x^2 + y^2 = 4a^2$

117. (b)
a parabola

Explanation:
$y = 4at$
Squaring both sides,we get
$y^2 = 16a^2t^2$
Putting the value of at^2 i.e. $at^2 = \frac{y^2}{16a}$ in $x = at^2$ we get,
$16ax = y^2$
or $y^2 = 4(4a)x$
which is nothing but equation of parabola.

118. (a)
a hyperbola

Explanation:
it is called rectangular hyperbola.

119. (b)
an ellipse

Explanation:
parametric form of ellipse.

120. (a)
2

Explanation:
The given equation of the circle can be written as
$(x-1)^2 - 1 + (y- 2)^2 - 4 = 0$
$(x - 1)^2 + (y + 2)^2 = 5$
This implies the radius is $\sqrt{5}$ and the centre is (1,-2)
The given point is (-1,2)
The distance between the centre of the circle and the given point is
$\sqrt{(-1-1)^2 + (2+2)^2}$ = $\sqrt{20}$
Sice this is greater than the radius, the point lies outside the circle. Hence two tangents can be drawn.