Atomic Energy Central School No 4 Rawatbhata

Multiple Choice Questions Examination (November 2019-20)

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

Name of student : _____Roll No._____Class Sec_____

Date: _____ Invigilator's Sign: _____

Physics

1. Some scientists have predicted that a global nuclear war on the earth would be followed by a severe 'nuclear winter' with a devastating effect on life on earth. What might be the basis of this prediction? **1**

   a) The clouds produced by global nuclear war would perhaps cover substantial parts of the sky preventing solar light from reaching many parts of the globe
   b) Nuclear reactions absorb visible light causing dark days/nights
   c) Nuclear reactions absorb atmospheric heat causing cooling
   d) None of these

2. Electromagnetic waves propagate **1**

   a) slower in a dielectric
   b) None of these
   c) at the same speed in a dielectric
   d) faster in a dielectric

3. How much time does it take light to travel from the moon to the earth, a distance of 384,000 km? **1**

   a) 1.48 s
   b) 1.58 s
   c) 1.28 s
   d) 1.38 s

4. Radio station WCCO in Minneapolis broadcasts at a frequency of 830 kHz. Wavelength and angular wave number are **1**

   a) 361 m, 0.0174 /m
   b) 381 m, 0.0174 rad/m
   c) 391 m, 0.0174 rad/m
   d) 371 m, 0.0174 rad/m

5. These are 3 wavelengths 10^{7}m, 10^{-10}m, 10^{-7}m. Find their respective names: **1**

   a) Visible rays, Y-rays, X-rays
   b) X-Rays, Visible rays, Radiowaves
   c) Radiowaves, X-rays, visible rays
   d) X-rays, Y-rays, Visible rays

6. Part of the electromagnetic spectrum to which 14.4 keV [energy of a particular transition in ^{57}Fe nucleus associated with a famous high resolution spectroscopic method (Mossbauer spectroscopy)] belongs is **1**

   a) X-rays (or soft γ-rays) region
   b) Microwave
   c) Gamma rays
   d) Ultraviolet

7. The speed of electromagnetic waves in a medium of dielectric constant 2.25 and relative permeability 4 is: **1**

   a) $3 \times 10^{8} m/s$
   b) $2 \times 10^{8} m/s$
   c) $2.5 \times 10^{8} m/s$
   d) $1 \times 10^{8} m/s$

8. Medical x rays are taken with electromagnetic waves having a wavelength of around 0.10 nm. What are the frequency and period of such waves? **1**

   a) $3.4 \times 10^{15}\text{Hz}, 3.3 \times 10^{-17}\text{s}$
   b) $3 \times 10^{15}\text{kHz}, 3.3 \times 10^{-17}\text{s}$
   c) $3.2 \times 10^{15}\text{Hz}, 3.3 \times 10^{-17}\text{s}$
   d) $3.2 \times 10^{15}\text{Hz}, 3.3 \times 10^{-17}\text{s}$

9. High intensities of UV light **1**

   a) are low in energy
   b) kills dangerous bacteria and therefore good
   c) are hazardous to the eyes
   d) is useful to good health

10. 7.5 MHz to 12 MHz band corresponds to wavelength band of **1**

    a) 7.5 m - 12 m
    b) 25 m – 40 m
    c) 50 m – 75 m
    d) 12 m - 7.5 m

11. Electromagnetic waves are transverse in nature is evident by: **1**

a) Polarization
b) Reflection
c) Diffraction
d) Interference

12. What physical quantity is the same for X-rays of wavelength 10^{-10} m, red light of wavelength 6800 $\overset{0}{A}$ and radio waves of wavelength 500m? 1

a) speed
b) phase
c) frequency
d) energy

13. Do EM waves need a medium to travel through? 1

a) No
b) Yes
c) Ether is required
d) None of these

14. Part of the electromagnetic spectrum to which 2.7 K [temperature associated with the isotropic radiation filling all space-thought to be a relic of the 'big-bang' origin of the Universe] belongs is 1

a) Microwave
b) Radio
c) Gamma rays
d) Ultraviolet

15. Suppose that the electric field part of an electromagnetic wave in vacuum is E = {(3.1 N/C) cos [(1.8 rad/m) y + (5.4 $\times 10^6$ rad/s)t]} i . Wavelength λ, frequency ν and the amplitude of the magnetic field part of the wave are 1

a) 4.0 m, 86 MHz, 250 nT
b) 3.5 m, 90 MHz, 200 nT
c) 5.5 m, 96 MHz, 100 nT
d) 3.5 m, 0.86 MHz, 10 nT

16. Optical and radio telescopes are built on the ground, but X-ray Astronomy is possible only from satellites orbiting the earth because 1

a) Atmosphere reflects X-rays away from earth
b) Atmosphere reflects X-rays horizontally so they don't reach the earth
c) Atmosphere absorbs X-rays, while visible and radio waves can penetrate it.
d) Satellites orbiting the earth make use of interstellar effects

17. The small ozone layer on top of the stratosphere is crucial for human survival because 1

a) It absorbs ultraviolet radiations from the sun and prevents it from reaching the earth's surface and causing damage to life.
b) Layer on top of the stratosphere is crucial as it supplies oxygen to atmosphere
c) It prevents water molecules from escaping into space
d) None of these

18. Velocity of plane electromagnetic waves in vacuum equals _____ 1

a) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$
b) $\sqrt{\mu_0 \varepsilon_0}$
c) $\mu_0 \varepsilon_0$
d) $\frac{2}{\sqrt{\mu_0 \varepsilon_0}}$

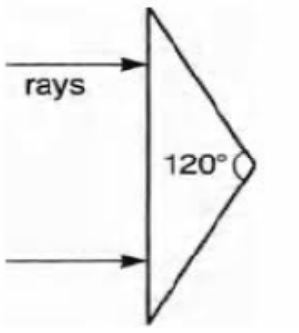
19. The frequencies of X-rays, Y-rays and ultra violet rays are respectively a, b and c. Then 1

a) a > b, b > c
b) a < b. b < c
c) a > b, b < c
d) a < b, b > c

20. The amplitude of the magnetic field part of a harmonic electromagnetic wave in vacuum is B_0 = 510 nT. Amplitude of the electric field part of the wave is 1

a) 163N/C
b) 158N/C
c) 153 N/C
d) 173N/C

21. An isosceles prism of angle 120° has a refractive index of 1.44. Two parallel monochromatic rays enter the prism parallel to each other in air as shown. The rays emerging from the opposite faces 1



a) make an angle of 2 $\sin^{-1}$ (0.72) with each other

b) are diverging

c) make an angle of 2 [$\sin^{-1}$(0.72) – 30°] with each other

d) are parallel to each other

22. A thin convergent glass lens (μ_g = 1.5) has a power of + 5.0 D. When this lens is immersed in a liquid of refractive index μ_1 it acts as a divergent lens of focal length 100 cm. The value of μ_1 must be 1

a) $\frac{4}{3}$

b) $\frac{5}{3}$

c) $\frac{5}{4}$

d) $\frac{6}{5}$

23. A person uses spectacles of power +2D, He is suffering from: 1

a) Presbyopia

b) Short sightedness or myopia

c) Long sightedness or hypermetropia

d) Astigmatism

24. The graph drawn with object distance along abscissa & image as ordinate for a convex lens is 1

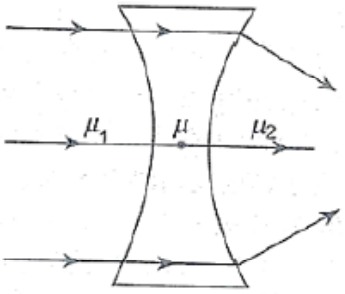
a) straight

b) circle

c) rectangular hyperbola

d) parabola

25. What is the relation between refractive indices μ, μ_1 and μ_2 if the behavior of light rays is as shown in the following figure? 1



a) $\mu < \mu_2; \mu = \mu_1$

b) $\mu < \mu_2 < \mu_1$

c) $\mu > \mu_2 > \mu_1$

d) $\mu_2 < \mu_1; \mu = \mu_2$

26. The largest telescope in the world has a reflector with an aperture of 200 inches in order to achieve 1

a) low dispersive power

b) least spherical aberration

c) high resolving power

d) high accommodation power

27. Blue colour of clear sky is due to phenomenon of: 1

a) Reflection

b) Scattering

c) Refraction

d) Dispersion

28. Band spectrum is also called: 1

a) Molecular spectrum

b) Atomic spectrum

c) Flash spectrum

d) Line absorption spectrum

29. To print a photograph from a negative, the time of exposure to light from a lamp placed 60 cm away is 2.5 s. What exposure time is required if the lamp is placed 1.2 m away? 1

a) 5 s

b) 10 s

c) 15 s

d) 20 s

30. A bird flies down vertically towards a water surface. To a fish inside the water, vertically below the bird, 1

the bird will appear to

a) move faster than its actual speed

b) be at its actual distance

c) move slower than its actual speed

d) be closer than its actual distance

31. According to Cartesian sign convention _____ 1

a) Distances measured in the same direction as the incident light are taken as negative

b) None of these

c) Distances measured in the same direction as the incident light are taken as positive

d) Distances measured in the same direction as the reflected/refracted ray are taken as positive

32. A lamp and a screen are set up 100 cm apart and a convex lens is placed between them. The two positions of the lens forming real images on the screen are 40 cm apart. What is the focal length of the lens? 1

a) 15 cm
b) 21 cm
c) 18 cm
d) 12 cm

33. A telescope has an objective of focal length 100 cm and an eye-piece of focal length 5 cm. What is the magnifying power of the telescope when it is in normal adjustment? 1

a) 20.0
b) 2.0
c) 0.2
d) 200

34. A plano-convex lens is made of glass of refractive index 1.5.The focal length f of the lens and radius of curvature R of its curved face are related as 1

a) $f = \frac{R}{2}$
b) f = R
c) f = 2 R
d) $f = \frac{3}{2R}$

35. A spherical surface of radius of curvature R separates air (refractive index =1) from glass (refractive index 1.5). The centre of curvature is in the glass. A point object P placed in air is found to have a real image Q in the glass. The line PQ cuts the surface at point O and PO = OQ. The distance PO is equal to 1

a) 1.5 R
b) 3 R
c) 5 R
d) 2 R

36. In a compound microscope, maximum magnification is obtained when the final image 1

a) coincides with the objective
b) is formed at the least distance of distinct vision
c) coincides with the object
d) is formed at infinity

37. The layered lens is made of two kinds of glass. A point source of light is placed on its principal axis. If the reflections from the boundaries between layers are ignored, the lens will form 1

a) no image at all
b) two images
c) infinite images
d) only one image

38. The magnifying power of telescope is high if 1

a) the objective has a long focal length and the eye-piece has a short focal length
b) both objective and eye-piece have short focal lengths
c) the objective has a short focal length and the eye-piece has a long focal length
d) both objective and eye-piece have long focal length

39. When light is passed through a prism, the colour which deviates least is: 1

a) Red
b) Blue
c) Green
d) Violet

40. The objective of a telescope has a focal length of 1.2 m. It is used to view a 10.0 m tall tower 2 km away. What is the height of the image of the tower formed by the objective? 1

a) 4 mm
b) 2 mm
c) 6 mm
d) 8 mm

Chemistry

41. When ethanal is heated with Fehlings solution, it gives a precipitate of: 1

a) Cu + Cu_2O + CuO
b) CuO
c) Cu
d) Cu_2O

42. Nucleophilic addition will be most favoured in: 1

a) CH_3CH_2CHO
b) $CH_3CH_2CH_2-\overset{\overset{O}{\|}}{C}-CH_3$
c) CH_3CHO
d) $(CH_3)_2C = O$

43. CH CHO and C H CH CHO can be distinguished chemically by: 1

a) Iodoform test
b) Benedict test
c) 2,4 DNP test
d) Tollen's reagent test

44. Oximes are formed by the reaction of aldehydes and ketones with 1

a) NH_2NH_2
b) NH_2OH
c) NH_3
d) $NH_2NHC_6H_5$

45. One mole of a symmetrical alkane on ozonolysis gives two moles of an aldehyde having molecular mass of 44u. The alkene is 1

a) 1 – butene
b) 2 – butene
c) Propene
d) Ethene

46. For making distinction between 2 – pentanone and 3 – pentanone the reagent to be employed is 1

a) $K_2Cr_2O_7 / H_2SO_4$
b) SeO_2
c) Zn – Hg/HCl
d) Iodine/NaOH

47. In Hell – Volhard Zelinsky reaction, halogen reacts with 1

a) aldehydes
b) ketones
c) carboxylic acids
d) ethers

48. The cannizzaro's reaction is not given by: 1

a) Acetaldehyde
b) Benzaldehyde
c) Trimethyl acetaldehyde
d) Formaldehyde

49. Which of the following acids does not exhibit optical isomerism? 1

a) Maleic acid
b) Tartaric acid
c) α – amino acids
d) Lactic acid

50. Reduction of aldehydes and ketones into hydrocarbons using zinc amalgam and conc. HCl is called 1

a) Clemmensen reduction
b) Wolff – Kishner reduction
c) Cope reduction
d) Dow reduction

51. Which of the following has most acidic hydrogen? 1

a) 2, 3 – Hexanedione
b) 2, 5 – Hexanedione
c) 2, 4 – Hexanedione
d) 3 – Hexanone

52. The reagent which can be used to distinguish acetophenone from benzophenone is: 1

a) I_2 and NaOH
b) 2, 4-dinitrophenyl hydrazine
c) Tollen's reagent
d) Benedict solution

53. Which of the following statements is not correct? 1

a) Aldehydes and ketones undergo nucleophilic addition.
b) Aldehydes and ketones contain polar carbonyl group
c) Aldehydes and ketones undergo electrophilic substitution.
d) Lower members of aldehydes and ketones are soluble in water due to hydrogen bonding

54. What compound is produced when cyclohexene is treated with concentrated KMnO ? 1

a) succinic acid
b) adipic acid
c) hexanoic acid
d) cyclohexanecarboxylic acid

55. Clemmensen reduction of a ketone is carried out in the presence of which of the following? 1

a) Zn – Hg with HCl
b) H_2 and Pt as catalyst
c) $LiAlH_4$
d) Glycol with KOH

56. Benzene reacts with CH COCl in the presence of AlCl to give: 1

a) $C_6H_5COCH_3$
b) C_6H_5COCl
c) $C_6H_5CH_3$
d) C_6H_5Cl

57. Ketones are reduced to the corresponding alcohols by catalytic hydrogenation to form 1

a) secondary alcohols
b) primary alcohols
c) None of these
d) tertiary alcohols

58. Methyl ketones are usually characterized by: 1

a) Benedict's reagent
b) Iodoform test
c) Schiff's test
d) Tollen's reagent

59. What compound is produced when (CH) CHCH Br is subjected to the following sequence of steps: 1

1. Mg, Et_2O,
2. CO_2,
3. H_3O^+?

a) 3 – methylbutanoic acid
b) 2 – methylpropanoic acid
c) 2 – methylhexanoic acid
d) 3 – methylpropanoic acid

60. A mixture of benzaldehyde and formaldehyde on heating with aqueous NaOH solution gives 1

a) benzyl alcohol and methyl alcohol
b) benzyl alcohol and sodium formate
c) sodium benzoate and methyl alcohol
d) sodium benzoate and sodium formate

61. Which of the following is a secondary amine _ 1

a) N,N-dimethylaniline
b) 3 – pentanamine
c) N-ethyl propan -1-amine
d) cyclohexylamine

62. Aniline does not undergo Friedel – Crafts reaction 1

a) Anilium ion deactivates any further reaction
b) Aluminium chloride, reacts with Aniline
c) All of these
d) $AlCl_3$ act as a catalyst

63. Aniline upon heating with conc. HNO and conc. H SO mixture gives: 1

a) mixture of o,p and m nitroaniline
b) no reaction
c) o-and p-nitroaniline
d) o-nitroaniline

64. Arrange the following in order of increasing basicity: aniline, p – nitroaniline, p – toluidine,and p – methoxyaniline 1

a) p – nitroaniline < aniline< p – methoxyaniline < p – toluidine
b) p – methoxyaniline p – nitroaniline < aniline < p – toluidine
c) p – nitroaniline < aniline < p – toluidine < p – methoxyaniline
d) aniline < p – methoxyaniline p – nitroaniline < p – toluidine

65. Direct nitration of aniline yields significant amount of meta derivative. To obtain more p – nitro derivative, one or more of the below can be done 1

a) All of these
b) by increasing temperature
c) controlling the nitration reaction
d) reacting with acetic anhydride

66. In a coupling reaction, the azo products obtained, involve an 1

a) Electrophilic substitution reaction
b) –N=N– bond
c) Nucleophilic substitution
d) –N=N– bond and electrophilic substitution reaction

67. Which gives a primary amine upon reduction? 1

a) CH_3CH_2NC
b) $C_6H_5N = NC_6H_5$
c) $CH_3CH_2 - O - N = O$
d) $CH_3CH_2NO_2$

68. Hinsberg's reagent is: 1

a) Benzene sulphonic acid
b) Benzene sulphonamide
c) Phenyl isocyanide
d) Benzene sulphonyl chloride

69. Reaction of nitrous acid with aliphatic primary amine in cold acidic solution gives: 1

a) A diazonium salt
b) A nitrite
c) A dye
d) An alcohol

70. Aniline does not undergo one of the following 1

a) Bromination
b) Nitration
c) Sulphonation
d) Friedal Craft Reaction

71. The Gabriel synthesis of amine undergo which kind of reaction? 1

a) Nucleophilic substitution reaction (SN_2)
b) Elimination reaction
c) Electrophilic substitution reaction
d) SN^1

72. Arrange the following compounds in order of increasing boiling point: CH NHCH CH ; CH OCH CH ; $(CH_3)_3N$ and $CH_3CH_2CH_2OH$. 1

a) Low to high; $CH_3OCH_2CH_3$.; $(CH_3)_3N$; $CH_3NHCH_2CH_3$; $CH_3CH_2CH_2OH$.
b) Low to high: $CH_3NHCH_2CH_3$; $CH_3CH_2CH_2OH$.; $(CH_3)_3N$; $CH_3OCH_2CH_3$.
c) Low to high: $(CH_3)_3N$; $CH_3OCH_2CH_3$; $CH_3NHCH_2CH_3$; $CH_3CH_2CH_2OH$.
d) Low to high: $CH_3CH_2CH_2OH$; $CH_3NHCH_2CH_3$; $(CH_3)_3N$; $CH_3OCH_2CH_3$.

73. Gabriel synthesis is used for the preparation of : 1

a) Quaternary salt
b) Primary amines
c) Tertiary amine
d) Secondary amine

74. Benzene diazonium chloride reacts with phenol in which the phenol molecule attack para position of phenol to form p – hydroxyazobenzene. This reaction is called 1

a) Carbon tetra chloride
b) DDT
c) Iodoform
d) Coupling reaction

75. Which of the following reacts with NaNO + HCl to give alcohol? 1

a) $C_6H_5CH_2NHCH_3$
b) CH_3NH_2
c) $C_6H_5NH_2$
d) $(CH_3)_3N$

76. Which of the following reactions is given by only primary amines? 1

a) reaction with acetyl chloride
b) reaction with HONO
c) reaction with Grignard reagent
d) reaction with chloroform and alcoholic KOH

77. Which one of the following cannot be obtained by Gabriel phthalimide synthesis? 1

a) CH_3NH_2
b) None of these
c) $CH_3CH_2NH_2$
d) Aromatic primary amines

78. Aniline reacts with NaNO and HCl at low temperature to give: 1

a) chloroaniline
b) diazonium chloride
c) phenol
d) nitroaniline

79. Which one of the following reagents is most suitable in completing the following synthesis? 1

$$R-\overset{\overset{O}{\|}}{C}-NH_2 \rightarrow R-NH_2$$

a) $LiAlH_4$
b) Br_2+ NaOH
c) Sn
d) H_2 + Ni

80. When methylamine reacts with HCl, the product is 1

a) methyl ammonium chloride
b) methane and methyl chloride
c) methonoate chloride
d) methylammonia

Mathematics

81. Solution of $\frac{y}{x} = \sec y$ is 1

a) $x = \sin 2y + C$
b) $x = \sin y + C$
c) None of these
d) $x = cos\, y + C$

82. In a bank, principal increases continuously at the rate of 5% per year. An amount of Rs1000 is deposited with this bank, how much will it worth after 10 years $\left(e^{0.5} = 1.648\right)$. 1

a) Rs 1848
b) Rs 1648
c) Rs 1748
d) Rs 1948

83. General solution of $1+x^2)\, dy + 2xy\, dx = \cot x\, dx\ (x \neq 0)$ is 1

a) $y(1+x^2) = log|sinx| + c$
b) $y = (1+x)^{-1} \log|\sin x| - C(1+x^2)^{-1}$
c) $y = (1+x)^{-1} \log|\sin x| + C(1-x^2)^{-1}$
d) $y = (1+x)^{-1} \log|\sin x| - C(1-x^2)^{-1}$

84. General solution of $\frac{dy}{dx} + 2y = \sin x$ is 1

a) $y = \frac{1}{5}(2\sin x + \cos x) - Ce^{-2x}$
b) $y = \frac{1}{5}(2\sin x + \cos x) + Ce^{-2x}$
c) $y = \frac{1}{5}(2\sin x - \cos x) - Ce^{-2x}$
d) $y = \frac{1}{5}(2\sin x - \cos x) + Ce^{-2x}$

85. In a bank, principal increases continuously at the rate of r% per year. Find the value of r if Rs 100 double itself in 10 years (loge2 = 0.6931). 1

a) 9.93%
b) 7.93%
c) 6.93%
d) 8.93%

86. Forming a differential equation representing the given family of curves by eliminating arbitrary constants a and b from $y = a\,e^{3x} + be^{-2x}$ yields the differential equation 1

a) y" – y'+ 6y = 0
b) y" – y'– 6y = 0
c) y" + y'+ 6y = 0
d) y" + y'– 6y = 0

87. To form a differential equation from a given function 1

a) Differentiate the function once and add values to arbitrary constants
b) Differentiate the function successively as many times as the number of arbitrary constants
c) Differentiate the function twice and eliminate the arbitrary constants
d) Differentiate the function once and eliminate the arbitrary constants

88. General solution of $x\frac{dy}{dx} + y - x + xycot\ x = 0\ (x\ \neq 0)$ is 1

a) $y = \frac{1}{x} + \cot x + \frac{C}{x\sin x}$
b) $y = \frac{1}{x} - \cot x + \frac{C}{x\sin x}$
c) $y = \frac{1}{x} - \cot x - \frac{C}{x\sin x}$
d) $y = \frac{1}{x} + \cot x - \frac{C}{x\sin x}$

89. A differential equation of the form y' = F(x,y) is homogeneous if 1

a) F(x,y) is a homogeneous function of degree zero
b) F(x,y) is a homogeneous function of degree three
c) F(x,y) is a homogeneous function of degree one
d) F(x,y) is a homogeneous function of degree two

90. Solution of differential equation $\frac{dy}{dx} = \frac{x+y}{x-y}$ is 1

a) $\tan^{-1}\left(\frac{y}{x}\right) = \frac{1}{2}\log(x^2+y^2) + C$
b) $\tan^{-1}\left(\frac{y}{x}\right) = \frac{1}{2}\log(x^3+y^2) + C$
c) $\tan^{-1}\left(\frac{y}{x}\right) = \log(x^3+y^2) + C$
d) None of these

91. Solution of $x\ dy - ydx = \sqrt{x^2+y^2}\ dx$ is 1

a) $y + \sqrt{x^2+y^2} = Cx^2$
b) $y + \sqrt{3+y^2} = Cx^4$
c) $y + \sqrt{x^3+y^2} = Cx^2$
d) $y + \sqrt{x^2+y^3} = Cx^2$

92. For the differential equation $xy\frac{dy}{dx} = (x+2)(y+2)$ find the solution curve passing through the point (1, –1). 1

a) $y + x + 2 = log\left(x^2(y+2)^2\right)$
b) $y - x - 2 = log\left(x^2(y-2)^2\right)$
c) $y - x + 2 = log\left(x^2(y+2)^2\right)$
d) $y - x - 2 = log\left(x^2(y+2)^2\right)$

93. Forming a differential equation representing the given family of curves by eliminating arbitrary constants a and b from $y = e^x$ (a cosx + b sinx) yields the differential equation 1

a) y" – 2y' - 2y = 0
b) y" – 2y' + 2y = 0
c) y" + 2y' - 2y = 0
d) y" +2y' + 2y = 0

94. Find a particular solution of $\frac{dy}{dx} = y\tan x$; y =1 when x = 0 1

a) y = tan x
b) y = sec x
c) y = sin x
d) y = cos x

95. Find the equation of a curve passing through the point (0, –2) given that at any point (x, y) on the curve, the product of the slope of its tangent and y coordinate of the point is equal to the x coordinate of the point. 1

a) $y^3 - x^2 = 4$
b) $y^3 - x^3 = 4$
c) $y^2 - x^3 = 4$
d) $y^2 - x^2 = 4$

96. Let $\vec{} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k} and\ \vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}\ and\ \vec{b}$, $and\ \vec{c}.\vec{d} = 15$. 1

a) $\frac{1}{3}\left(-160\hat{i} - 5\hat{j} + 70\hat{k}\right)$
b) $\frac{1}{3}\left(160\hat{i} - 5\hat{j} - 70\hat{k}\right)$
c) $\frac{1}{3}\left(160\hat{i} - 5\hat{j} + 70\hat{k}\right)$
d) $\frac{1}{3}\left(160\hat{i} + 5\hat{j} - 70\hat{k}\right)$

97. If a unit vector makes angles $\frac{\pi}{3}\ with\ \hat{i}$, $\frac{\pi}{4}\ with\ \hat{j}\ and\ an\ acute\ angle\ \theta\ with\ \hat{k}$, then the components of $\vec{a}$ are 1

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

98. Find the direction cosines of the vector joining the points A(1, 2, –a3) and B(–1, –2, 1), directed from A to B. 1

a) $-\frac{1}{3}, \frac{2}{3}, \frac{2}{3}$ b) $-\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$

c) $\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$ d) $-\frac{1}{3}, -\frac{2}{3}, -\frac{2}{3}$

99. If is the angle between any two vectors $\vec{a}$ and $\vec{b}$, then $\left|\vec{a}.\vec{b}\right| = \left|\vec{a} \times \vec{b}\right|$ when θ is equal to 1

a) $\frac{\pi}{3}$ b) $\frac{\pi}{2}$

c) $\frac{\pi}{4}$

100. Find a unit vector perpendicular to each of $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, where 1

$\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$

a) $\pm\frac{2}{3}\hat{i} \mp \frac{2}{3}\hat{j} \mp \frac{1}{3}\hat{k}$ b) $\pm\frac{2}{3}\hat{i} \pm \frac{2}{3}\hat{j} \pm \frac{1}{3}\hat{k}$

c) $\pm\frac{2}{3}\hat{i} \pm \frac{2}{3}\hat{j} \pm \frac{1}{3}\hat{k}$ d) $\pm\frac{2}{3}\hat{i} \pm \frac{2}{3}\hat{j} \pm \frac{1}{3}\hat{k}$

101. Area of a rectangle having vertices A, B, C and D with position vectors 1

$-\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}$, $\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}$, $\hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}$ and $-\hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}$ respectively is

a) 1 b) 2

c) 4 d) 1/2

102. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|b| = \frac{\sqrt{2}}{3}$, then $\vec{a} \times \vec{b}$ is a unit vector if the angle 1

between vectors $\vec{a}$ and $\vec{b}$ is

a) $\frac{\pi}{4}$ b) $\frac{\pi}{3}$

c) $\frac{\pi}{6}$ d) $\frac{\pi}{2}$

103. In triangle ABC, which of the following is not true? 1

a) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = 0$ b) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{CA} = 0$

c) $\overrightarrow{AB} - \overrightarrow{CB} + \overrightarrow{CA} = 0$ d) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{AC} = 0$

104. If the vertices A, B, C of a triangle ABC are (1, 2, 3), (–1, 0, 0), (0, 1, 2), respectively, then find 1

$\angle ABC$. [$\angle ABC$ is the angle between the vectors $\overrightarrow{BA}$ and $\overrightarrow{BC}$]

a) $\cos^{-1}\left(\frac{13}{\sqrt{102}}\right)$ b) $\cos^{-1}\left(\frac{11}{\sqrt{102}}\right)$

c) $\cos^{-1}\left(\frac{15}{\sqrt{102}}\right)$ d) $\cos^{-1}\left(\frac{10}{\sqrt{102}}\right)$

105. Find the area of the triangle with vertices A(1, 1, 2), B(2, 3, 5) and C(1, 5, 5). 1

a) $\frac{\sqrt{65}}{3}$ b) $\frac{\sqrt{65}}{2}$

c) $\frac{\sqrt{61}}{3}$ d) $\frac{\sqrt{61}}{2}$

106. The scalar product of the vector $+\hat{j} + \hat{k}$ with a unit vector along the sum of vectors 1

$2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\lambda\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to one. Find the value of λ.

a) λ = 1 b) λ = -2

c) λ = 2 d) λ = -1

107. Find the unit vector in the direction of the vector $\vec{} = \hat{i} + \hat{j} + 2\hat{k}$ 1

a) $\vec{a} = -\frac{1}{\sqrt{6}}\hat{i} + \frac{1}{\sqrt{6}}\hat{j} + \frac{2}{\sqrt{6}}\hat{k}$ b) $\vec{a} = \frac{1}{\sqrt{6}}\hat{i} + \frac{1}{\sqrt{6}}\hat{j} + \frac{2}{\sqrt{6}}\hat{k}$

c) $\vec{a} = \frac{1}{\sqrt{6}}\hat{i} + \frac{1}{\sqrt{6}}\hat{j} - \frac{2}{\sqrt{6}}\hat{k}$ d) $\vec{a} = \frac{1}{\sqrt{6}}\hat{i} - \frac{1}{\sqrt{6}}\hat{j} + \frac{2}{\sqrt{6}}\hat{k}$

108. Find λ and μ if $\left(2\hat{i} + 6\hat{j} + 27\hat{k}\right) \times \left(\hat{i} + \lambda\hat{j} + \mu\hat{k}\right) = \vec{0}$ 1

a) 5, $\frac{27}{2}$ b) 3, $\frac{27}{2}$

c) 3, $\frac{27}{5}$ d) 4, $\frac{27}{2}$

109. Show that the points A(1, – 2, – 8), B (5, 0, – 2) and C (11, 3, 7) are collinear, and find the ratio in which B divides AC. 1

a) 3 :2 b) 2 :4

c) 2 : 3 d) 2 :1

110. $\vec{} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ *and* $\vec{c} = 3\hat{i} + \hat{j}$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then the value of λ is 1

a) 9 b) 8

c) 11 d) 7

111. Maximize Z = – x + 2y, subject to the constraints: x ≥ 3, x + y ≥ 5, x + 2y ≥ 6, y ≥ 0. 1

a) Z has no maximum value b) Maximum Z = 14 at (2, 6)

c) Maximum Z = 12 at (2, 6) d) Maximum Z = 10 at (2, 6)

112. Maximize Z = 50x + 60y , subject to constraints x +2 y ≤ 50 , x +y ≥ 30, x, y ≥ 0. 1

a) 1600 b) 1547

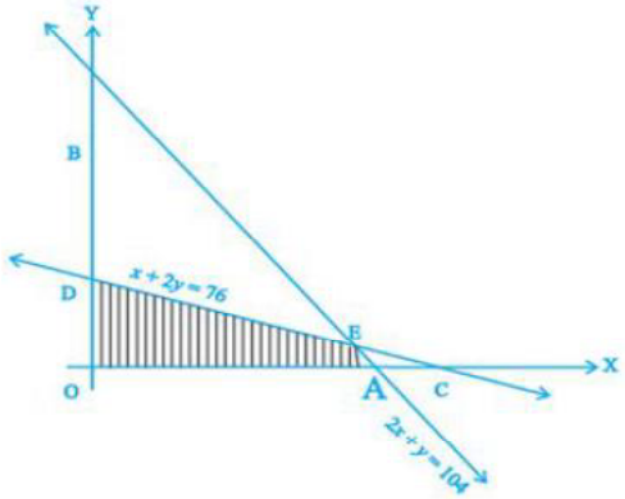
c) 2500 d) 1525

113. Maximize Z = 5x+3y , subject to constraints x + y ≤ 300 , 2x + y ≤ 360, x ≥ 0, y ≥ 0. 1

a) 1020 b) 1050

c) 1040 d) 1030

114. Determine the maximum value of Z = 3x + 4y if the feasible region (shaded) for a LPP is shown in Figure above. 1



a) 226 b) 196

c) 216 d) 206

115. 2) Which of the following is not a vertex of the positive region bounded by the inequalities 2x+3y≤6, 5x+3y≤15, and x, y≥0

a) (0,2) b) (0,0) c) (3,0) d) None of these

116. A basic solution is called non-degenerate, if

a) All the basic variables are zero b) None of the basic variables is zero

c) At least one of the basic variables is zero d) None of these

117. Objective function of a L.P.P. is

a) a constraint b) a function to be optimized c) a relation between 2 variables d) None

118. Which of the terms is not used in a linear programming problem

a) Slack variables b) Objective function c) Concave region d) feasible region

119. For the L.P. problem Min z=2x+y subject to 5x+10y≤50,x+y≥1, y≤4 and x, y≥0,z=

a)0 b)1 c)2 d) ½

120. z=ax+by, a, b being positive, under constraints y≥1, x−4y+8≥0, x, y≥0 has

a) Finite maximum b) Finite minimum c) unbounded min solution d) unbounded max soln

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Solution

Class 12 - Physics

Multiple Choice Examination (2019-20)

Section A

1. (a)
The clouds produced by global nuclear war would perhaps cover substantial parts of the sky preventing solar light from reaching many parts of the globe

Explanation:
Nuclear winter is the severe and prolonged global climatic cooling effect hypothesized to occur after widespread firestorms following a nuclear war. The hypothesis is based on the fact that such fires can inject soot into the stratosphere, where it can block some direct sunlight from reaching the surface of the Earth. It is speculated that the resulting cooling would lead to widespread crop failure and famine.

2. (a)
slower in a dielectric

Explanation:
Speed of light is inversely proportional to square root of dielectric constant. Hence it decreases in dielectric.

3. (c)
1.28 s

Explanation:
$time = \frac{distance}{speed} = \frac{384000 \times 1000m}{3 \times 10^8} = 1.28s$

4. (a)
361 m, 0.0174 /m

Explanation:
$\lambda = \frac{c}{\nu} = \frac{3 \times 10^8}{830 \times 10^3} = 361m$
Angular wave number, $k = \frac{2\pi}{\lambda} = \frac{2\pi}{361} = 0.0174/m$

5. (c)
Radiowaves, X-rays, visible rays

Explanation:
Radiowaves have wavelength > 0.1m
X-rays have wavelength 1nm to 10^{-3} nm
visible rays have wavelength 400nm to 700nm

6. (a)
X-rays (or soft γ-rays) region

Explanation:
14.4 keV [energy of a particular transition in ^{57}Fe nucleus associated with a famous high resolution spectroscopic method (Mossbauer spectroscopy)] belongs to X-ray region.

7. (d)
$1 \times 10^8 m/s$

Explanation:
speed of light in medium = $\frac{c}{\sqrt{\epsilon_r \mu_r}} = \frac{3 \times 10^8}{\sqrt{2.25 \times 4}} = 10^8 m/s$

8. (b)
$3 \times 10^{15}\text{kHz}, 3.3 \times 10^{-17}\text{s}$

Explanation:
$\nu = \frac{c}{\lambda} = \frac{3 \times 10^8}{0.1 \times 10^{-9}} = 3 \times 10^{18} Hz = 3 \times 10^{15} kHz$
$T = \frac{1}{\nu} = \frac{1}{3 \times 10^{18} Hz} = 3.33 \times 10^{-17} s$

9. (c) are hazardous to the eyes
Explanation:
UV rays has harmful effects on humans.

10. (b)
25 m – 40 m

Explanation:
$\lambda_1 = \frac{c}{\nu_1} = \frac{3 \times 10^8}{12 \times 10^6} = 25m$
$\lambda_2 = \frac{c}{\nu_2} = \frac{3 \times 10^8}{7.5 \times 10^6} = 40m$
Hence the corresponding wavelength range is 25 m - 40 m.

11. (a)
Polarization

Explanation:
Only transverse waves can be polarized. Longitudinal waves do not undergo polarization.
Whereas both, transverse and longitudinal waves can undergo interference, diffraction and reflection.

12. (a) speed
Explanation:
speed of entire em spectrum is same.

13. (a)
No

Explanation:
Oscillatory electric and magnetic field produces EM wave. As electric and magnetic field can propagate in vacuum, EM wave do not necessarily require medium.

14. (a) Microwave
Explanation:
2.7 K [temperature associated with the isotropic radiation filling all space-thought to be a relic of the 'big-bang' origin of the Universe] belongs to microwaves.

15. (d)
3.5 m, 0.86 MHz, 10 nT

Explanation:
$E_o = 3.1 N/C,\ k = 1.8 rad/m, \omega$
$= 5.4 \times 10^6 rad/s$
$\lambda = \frac{2\pi}{k} = \frac{2 \times 3.14}{1.8} \approx 3.5m$
$\nu = \frac{\omega}{2\pi} = \frac{5.4 \times 10^6}{2 \times 3.14} = 0.86 MHz$
$B_o = \frac{E_o}{c} = \frac{3.1}{3 \times 10^8} \approx 10^{-8} Tor\ 10nT$

16. (c) Atmosphere absorbs X-rays, while visible and radio waves can penetrate it.
Explanation:
Optical and radio waves can penetrate the atmosphere whereas x- rays, are of very short Wavelength and hence absorbed by the atmosphere. This is the reason why we can work with optical and radio telescopes

on earth's surface, but x-rays astronomical telescopes must be used on the satellite orbiting above the earth's atmosphere.

17. (a) It absorbs ultraviolet radiations from the sun and prevents it from reaching the earth's surface and causing damage to life.
Explanation:
Ozone layer absorbs UV rays

18. (a)
$\frac{1}{\sqrt{\mu_0 \epsilon_0}}$

Explanation:
Speed of light depends on electrical and magnetic properties of medium.

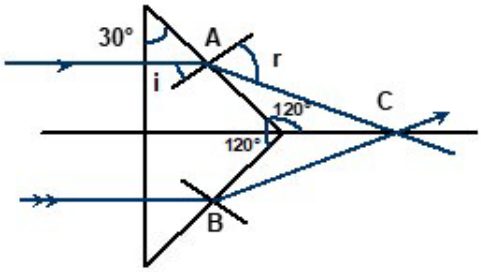
19. (d) a < b, b > c
Explanation:
Of the given region, frequency of Y- rays is maximum and that of UV is minimum, hence a < b, b > c

20. (c)
153 N/C

Explanation:
$E_o = c \times B_o = 3 \times 10^8 \times 510 \times 10^{-9}$
=153 N/C

21. (c)
make an angle of 2 [$\sin^{-1}$(0.72) – 30°] with each other

Explanation:



$\frac{\sin i}{\sin r} = \frac{1}{1.44}$ [$\because i = 30°$]
$\sin r = \frac{1.44}{2} = 0.72$
$\angle ACB = 2[180° - (120° + 90° - r)]$
$= 2(r - 30°) = 2[\sin^{-1}(0.72) - 30°]$

22. (b)
$\frac{5}{3}$

Explanation:
f = 1/P = 1/5 m = 20cm
$\frac{1}{f} = (\frac{\mu_2}{\mu_1} - 1)(\frac{1}{R_1} - \frac{1}{R_2})$
In air, $\frac{1}{20} = (\frac{1.5}{1} - 1)(\frac{1}{R_1} - \frac{1}{R_2}) = 0.5(\frac{1}{R_1} - \frac{1}{R_2})$ ....(i)
In liquid, $\frac{1}{-100} = (\frac{1.5}{\mu_1} - 1)(\frac{1}{R_1} - \frac{1}{R_2})$ ....(ii)
Dividing (i) by (ii)
$-5 = \frac{0.5}{(\frac{1.5}{\mu_1} - 1)}$
On solving we get, $\mu = 5/3 = 1.67$

23. (c) Long sightedness or hypermetropia
Explanation:

In hypermetropia the image of near by objects is formed behind the retina, hence a converging lens (convex lens) of suitable power is used to correct the defect. Focal length and hence the power of convex lens is positive.
Hence lens of positive of power is used to correct hypermetropia or long sightedness.

24. (c)
rectangular hyperbola

Explanation:

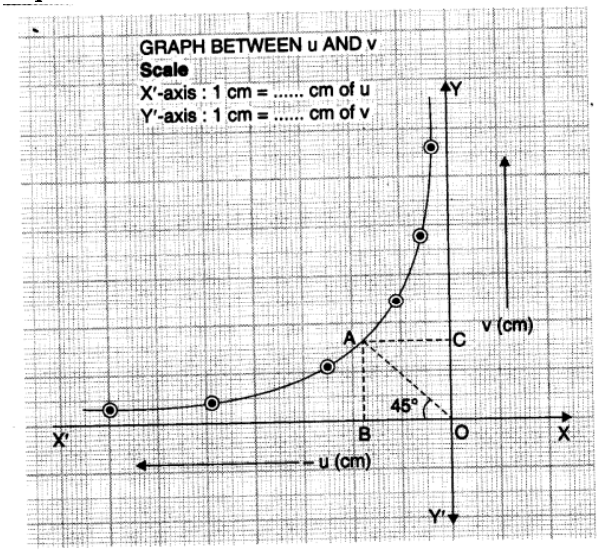


Fig. Graph between u and v. It is a rectangular hyperbola.

25. (a)
$\mu < \mu_2; \mu = \mu_1$

Explanation:
Since light rays do not get refracted while entering the lens, hence $\mu = \mu_1$
After emerging from concave lens, light rays converge hence $\mu < \mu_2$

26. (c) high resolving power
Explanation:
Resolving power is directly proportinal to aperture.

27. (b)
Scattering

Explanation:
Particles of atmosphere in clear sky are very small in size.
According to Rayleigh's criteria for scattering, scattering $\propto \frac{1}{\lambda^4}$
Since wavelength of violet, indigo and blue are very short hence they are scattered the most, resulting in blue appearance of sky.

28. (a)
Molecular spectrum

Explanation:
band spectrum are produced by molecules radiating their rotational or vibrational energies, or both simultaneously.
Whereas line spectra are also called atomic spectra because the lines represent wavelengths radiated from atoms when electrons change from one energy level to another.

29. (b)
10 s

Explanation:
exposure time $t \propto d^2$

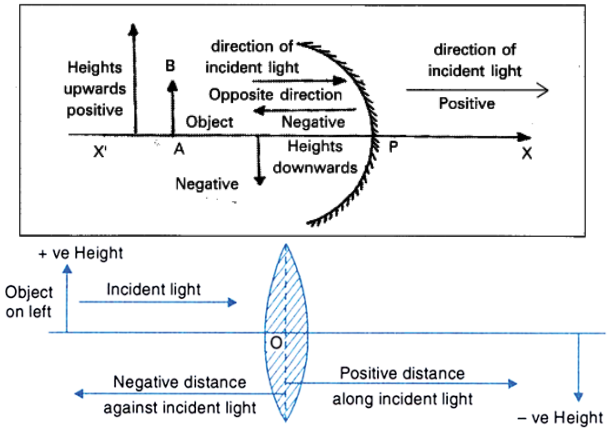
$\therefore t_2 = \frac{d_2^2}{d_1^2} t_1 = \frac{120^2}{60^2} 2.5 = 10s$

30. (a)
move faster than its actual speed

Explanation:
Let h be the actual height and h' be the apparent height of bird at any instant.
Then, $\frac{h}{h'} = \mu_{aw}$ (refractive index of air with respect to water) = 3/4 (since refractive index of water with respect to air is 4/3)
If v is the actual speed and v' be the apparent speed of bird, then
v = dh/dt and v' = dh'/dt
v/v' = (dh/dt) / (dh'/dt) = 3/4
or v' = 4v/3

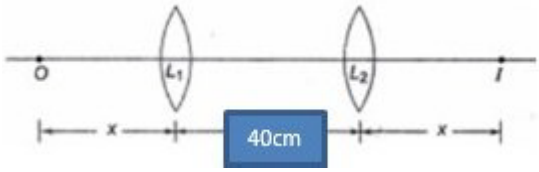
31. (c)
Distances measured in the same direction as the incident light are taken as positive

Explanation:



32. (b)
21 cm

Explanation:



Distance between two positions of lens, L_1L_2 = 40 cm and OI = 100cm
Let distance of object from L_1 = x, therefore u = -x, hence x + 40 + x = 100 or x = 30cm
for L_1 we have, u = -30 cm and v = 70 cm
Putting values in lens formula and solving we get f = +21 cm.

33. (a)
20.0

Explanation:
In case of normal adjustment, final image is formed at inifinity.
So magnifying power, $m = \frac{fo}{fe} = \frac{100}{5} = 20$

34. (c)

f = 2 R

Explanation:
$\frac{1}{f} = (\frac{\mu_2}{\mu_1} - 1)(\frac{1}{R_1} - \frac{1}{R_2})$
For plano convex lens, R_1 = infinite and R_2 = -R
Hence, $\frac{1}{f} = (1.5 - 1)(\frac{1}{\infty} - \frac{1}{-R})$
or f = 2R.

35. (c)
5 R

Explanation:
Given: $\mu_2 = 1.5; \mu_1 = 1$; OP = OQ = x (let)
For refraction at spherical surfaces from rarer to denser,
$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$
Applying sign convention, v = x and u = -x
$\frac{1.5}{x} - \frac{1}{-x} = \frac{1.5-1}{R}$
$\frac{2.5}{x} = \frac{1}{2R}$
or x = 5R.

36. (b) is formed at the least distance of distinct vision
Explanation:
magnification of compound microscope is given by:
$(\frac{v_o}{u_o})(1 + \frac{D}{f_e})$, when final image is formed at near point, whereas it is $(\frac{v_o}{u_o})(\frac{D}{f_e})$ when final image is formed at infinity.
Hence magnification is maximum when final image is formed at near point (least distance of distinct vision)

37. (d)
only one image

Explanation:
It is like a combination of two Plano – convex lenses. Therefore only one image is formed.

38. (a)
the objective has a long focal length and the eye-piece has a short focal length

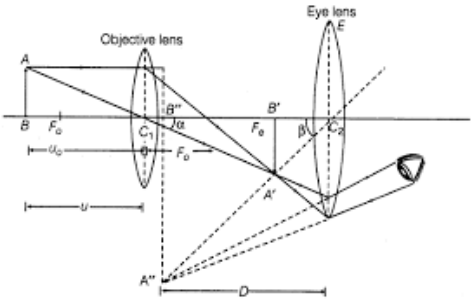
Explanation:
magnifying power of telescope is directly proportional to fo/fe.
Hence fo should be large and fe should be small.

39. (a)
Red

Explanation:
Refracting index is given by, $\mu = A + \frac{B}{\lambda^2}$, where A & B are constant.
Wavelength if red color is maximum, hence refractive index of material of prism for red color light is minimum hence red color deviates the least.

40. (c)
6 mm

Explanation:



Since tower n is situated very far (2000 m) so its image is at the focal plane of objective lens.
So angle subtended by tower is equal to angle subtended by the image, $\beta = \alpha$
or $tan\beta = tan\alpha$
or $\frac{10}{2000} = \frac{A'B'}{1.2}$
$\therefore\ A'B' = 6 \times 10^{-3} m = 6mm$

Solution

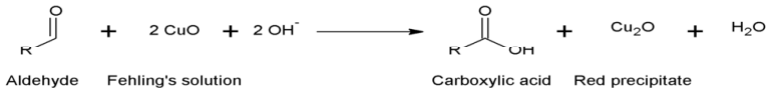
Class 12 - Chemistry

Multiple Choice Questions Examination

Section A

41. (d)
Cu_2O

Explanation:



aldehydes give positive fehling's test with a red precipitate of Cu_2O

42. (c)
CH_3CHO

Explanation:
Aldehydes are more reactive toward nucleophilic addition reaction than ketones because of two main reasons:

1. steric hinderance - ketones are more sterically hindered than aldehydes thus aldehydes are more reactive towards nucleophilic addition reaction.
2. Ketones have two alkyl groups which show +I effect and decreases the electron density on C and hence rate of nucleophilic addition decreases in ketones compared to aldehydes.
   If we have to compare aldehydes reactivity towards nucleophilic addition reaction then, steric hinderance has to be considered as steric hinderance increases, the reactivity of aldehydes decreases. so in given question answer will be CH_3CHO.

43. (a)
Iodoform test

Explanation:
CH_3CHO will give iodoform test and $C_6H_5CH_2CHO$ will not give iodoform test. Methyl aldehydes or ketones give iodoform test. In carbonyls like RCOR' one of R or R' should be a CH_3 group to give positive iodoform test.

$CH_3CHO + NaOI \rightarrow CHI_3 + HCOO^-Na^+$

CHI_3 formed is known as iodoform and is yellow precipitate.

$C_6H_5CH_2CHO + NaOI \rightarrow$ no reaction

44. (b)
NH_2OH

Explanation:
Aldehydes and ketones react with NH_2OH (hydroxylamine) to form oximes as shown in the given reaction.

$RCOR' + NH_2OH \rightarrow RR'C=NOH$ (oxime)

45. (b)
2 – butene

Explanation:
2-butene on reductive ozonolysis with O_3/Zn will give CH_3CHO which has molecular mass of 44u.

$CH_3CH=CHCH_3 + O_3/Zn \rightarrow 2CH_3CHO$

Molecular mass of CH CHO = 12+3+12+1+16 = 44u

46. (d)
Iodine/NaOH

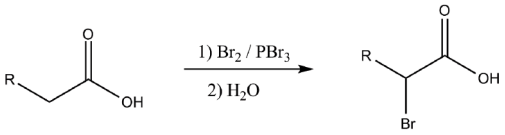
Explanation:
2-pentanone ($CH_3COCH_2CH_2CH_3$) will give iodoform test (reaction with I_2 + NaOH) because of presence CH_3CO- group and yellow precipitate will be formed but 3-pentanone ($CH_3CH_2COCH_2CH_3$) does not have CH_3CO- group hence will not give iodoform test.

$CH_3COCH_2CH_2CH_3 + I_2 + NaOH \rightarrow CHI_3$ (yellow precipitate) + $CH_3CH_2CH_2COO^-Na^+$

$CH_3CH_2COCH_2CH_3 + I_2 + NaOH \rightarrow$ No reaction

47. (c)
carboxylic acids

Explanation:
Alpha Hydrogen containing carboxylic acids undergo HVZ reaction. HVZ reaction is used for alpha halogenation of carboxylic acid.



48. (a)
Acetaldehyde

Explanation:
Acetaldehyde (CH_3CHO) have alpha hydrogen hence will undergo aldol reaction in presence of base rather than cannizaro reaction. Cannizaro reaction is given when there is no alpha hydrogen present on carbonyl group.

49. (a)
Maleic acid

Explanation:
Maleic Acid shows Geometrical Isomerism due restricted bond roation along C=C bond but does not give optical isomerism as it has horizontal plane of symmetry , as C=C bond is planar and thus do not form a non superimposable mirror image and is optically inactive .

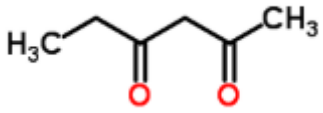
50. (a)
Clemmensen reduction

Explanation:
Clemmenson reduction is the reaction of carbonyl compounds with Zn amalgam in presence of conc. HCl to convert them to alkanes . >C=O group of carbonyl converts to -CH_2 group of alkanes.

$$RCOR' + Zn + Conc.\ HCl \rightarrow RCH_2R'$$
$$RCHO + Zn + Conc.\ HCl \rightarrow RCH_3$$

51. (c)
2, 4 – Hexanedione

Explanation:
2,4-hexanedione will have active methylene group.
The structure of 2,4-hexanedione is



-CH_2 group present between the two carbonyl group is active methylene group, these hydrogens are highly acidic as their conjugate base is highly stable.

52. (a)
I_2 and NaOH

Explanation:
Acetophenone and benzophenone both are ketones so, cannot be distinguised on the basis of tollens or benedicts test. Acetophenone has -$COCH_3$ great which give positive iodoform test while benzophenone doesnot give iodoform test thus I_2 + NaOH can be used.

53. (c)
Aldehydes and ketones undergo electrophilic substitution.

Explanation:
Aldehydes and ketones have polar C=O group therefore they undergo nucleophilic addition reactions. The oxygen being electronegative have a delta (small) negative charge and thus C attached to oxygen bears positive charge. Thus this electrophilic C attracts a nucleophile to add to its double bond. thus aldehydes and ketones undergo nucleophilic addition reactions.

54. (b)
adipic acid

Explanation:
Conc $KMnO_4$ will cause oxidative ozonolysis and ring opening forming adipic acid.
cyclohexene + conc. $KMnO_4 \rightarrow HOOC(CH_2)_4COOH$

55. (a)
Zn – Hg with HCl

Explanation:
For Clemmenson we use Zn-Hg(conc HCl). This reduction reduces carbonyl groups to alkane. this reduction cannot be used when an acid sensitive group is present.

56. (a)
$C_6H_5COCH_3$

Explanation:
$C_6H_6 + CH_3COCl \xrightarrow{AlCl_3} C_6H_5COCH_3$

This is known as friedal craft acylation reaction. $AlCl_3$ act as a lewis acid and will generate CH_3CO^+ carbocation and this will attack benzene to give $C_6H_5COCH_3$

57. (a)
secondary alcohols

Explanation:
Aldehydes on catalytic hydrogenation using H_2/Pt give primary alcohols while ketones on catalytic hydrogenation using H_2/Pt give secondary alcohols.

58. (b)
Iodoform test

Explanation:

$$CH_3COR + I_2 + NaOH \rightarrow CHI_3 + RCOO^-Na^+$$

Iodoform test is characteristic test given by methyl ketones. CHI formed is yellow precipitate.

59. (a)

3 – methylbutanoic acid

Explanation:

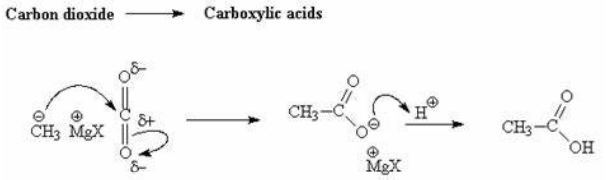
Firstly, alkyl bromide will react with Mg/ether to form Grignard reagent

$(CH_3)_2CHCH_2Br + Mg/ether \rightarrow (CH_3)_2CHCH_2MgBr$

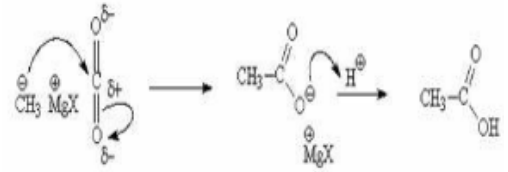
Now Grignard reagent formes will act as a nucleophile and attack O=C=O, followed by hydrolysis will form acid.

$(CH_3)_2CHCH_2MgBr + CO_2 + H_3O^+ \rightarrow (CH_3)_2CHCH_2COOH$

The general reaction of grignard (CH_3MgX) with CO_2 is as shown:



Carbon dioxide ⟶ Carboxylic acids



60. (b)

benzyl alcohol and sodium formate

Explanation:

They will undergo cannizaro reaction as neither benzaldehyde nor formaldehyde has alpha hydrogen. HCHO will be more reactive towards cannizaro compared to benzaldehyde because of less steric hinderance.

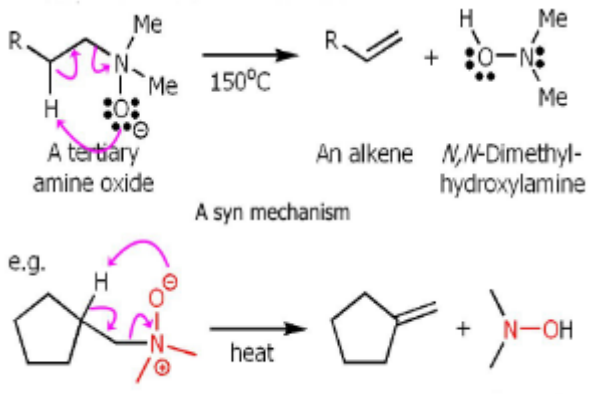
So, OH^- nucleophile will attck on HCHO first and then hydride shift from HCHO to benzaldehyde will occur. and thus HCHO will oxidise to $HCOO^-$ ion and benzaldehyde will reduce to benzylalcohol.

61. (c)

N-ethyl propan -1-amine

Explanation:

This is secondary amine because nitrogen is connected to 2 carbon atoms directly.



62. (b)

Aluminium chloride, reacts with Aniline

Explanation:
$AlCl_3$ being a lewis acid reacts with the lone pair of -NH_2 group of aniline forming an adduct ($C_6H_5NH_2^+AlCl_3$) which deactivates the benzene system hence no friedal craft reaction occurs.

63. (a)
mixture of o,p and m nitroaniline

Explanation:
mixture of ortho, meta and para nitroaniline is formed because of formation of anilinium ion which is formed by direct nitration of aniline.

64. (c)
p – nitroaniline < aniline < p – toluidine < p – methoxyaniline

Explanation:
-OMe group at a para position will increase the basicity more than-CH_3 group at the para position. While the presence of –NO_2 at a para position will decrease the basicity.

65. (d)
reacting with acetic anhydride

Explanation:
Direct nitration of aniline yield significant amount of meta derivative, this is because the use of HNO_3 during nitration of aniline causes the formation of anilinium ion($C_6H_5NH_3^+$). Anilinium ion is responsible for the formation of metra nitro aniline. To prevent this, initial reaction of aniline with acetic anhydride acetylates -NH_2 group.
$C_6H_5NH_2 + CH_3COOCOCH_3 \rightarrow C_6H_5NHCOCH_3$.
Now, -$NHCOCH_3$ is an activating group, which on nitration followed by hydrolysis form para nitro aniline as a major product.

66. (d)
–N=N– bond and electrophilic substitution reaction

Explanation:
Due to their positive charge, diazonium cations may participate in an electrophilic aromatic substitution as an electrophile. The electrophilic reaction center is the terminal nitrogen of the -$N=N^+$group. As a result, two aromatic compounds are coupled by a -N=N- group. This is known as the azo group (diazo group). The corresponding reaction is called diazonium coupling (diazo coupling, azo coupling). However, the electrophilicity of diazonium ions is only relatively weak, as their positive charge is delocalized.

67. (d)
$CH_3CH_2NO_2$

Explanation:
A primary nitro compound on reduction will give primary amine. The reduction can be done using Fe/HCl or Sn/HCl

68. (d)
Benzene sulphonyl chloride

Explanation:
Benzene sulphonyl chloride, $C_6H_5SO_2Cl_2$, is called Hinsberg reagent. It is used to distinguish between primary, secondary and tertiary amines.

69. (d)

An alcohol

Explanation:
Primary amine reacts with nitrous acid (HNO_2) to give diazonium salt which is unstable and decomposes to give a carbocation and evolve N_2 gas. The carbocation so formed reacts with H_2O from medium to form alcohol as major product.

$$\underset{ethan\,min\,e(ethyla\,min\,e)}{CH_3CH_2NH_2} \xrightarrow[HCl0^\circ]{NaNO_2} \underset{ethyl\ diazonium\ chloride(unstable)}{CH_3CH_2-\overset{+}{N}\equiv NCl^-}$$

$$CH_3CH_2\overset{+}{N}\equiv NCl^- \rightarrow [CH_3CH_2{}^+] + N_2 \xrightarrow{HOH} CH_3CH_2OH$$

70. (d)
Friedal Craft Reaction

Explanation:
The F.C. alkylation and F.C. acylation reaction take place in presence of Anhyd. $AlCl_3$, which is a Lewis base as it is electron deficient, it attacks the lone pair on nitrogen in aniline and forms an insoluble complex which precipitates out and reaction does not happen further.

$C_6H_5NH_2 + AlCl_3 \rightarrow C_6H_5NH_2{}^+AlCl_3$

71. (a)
Nucleophilic substitution reaction (SN_2)

Explanation:

- The reaction of phthalimide with KOH removes the **N-H** proton giving an imide ion, which is a good nucleophile.
- **Nucleophilic substitution (SN_2)** by the imide ion on the alkyl halide generates an intermediate, N-alkyl phthalimide.
- Hydrolysis or hydrazinolysis liberates a primary alkyl amine.
  Therefore, It is nucleophilic substitution reaction.

72. (c)
Low to high: $(CH_3)_3N$; $CH_3OCH_2CH_3$; $CH_3NHCH_2CH_3$; $CH_3CH_2CH_2OH$.

Explanation:
This is on the basis of inter molecular interactions.

33. (b)
Primary amines

Explanation:
In Gabriel Pthalamide reaction, the sodium or potassium salt of pthalimide is N-alkylated with a primary alkyl halide to give the corresponding *N*-alkylphthalimideis for producing primary amines. This is because of the reaction of sodium or potassium salt of phthalimide with alkyl halide impure SN_2 reaction.

74. (d)
Coupling reaction

Explanation:
In this reaction benzene and phenol get coupled through -N=N- linkage. The compounds containing this type of linkage are called azo compounds.

$C_6H_5N_2{}^+Cl^- + C_6H_5OH \rightarrow p\text{-}C_6H_5N{=}NC_6H_4OH$ (dye)

75. (b)
CH_3NH_2

Explanation:
Aliphatic primary amines react with nitrous acid (prepared in situ from $NaNO_2$ and a mineral acid such as HCl) to form aliphatic diazonium salts, which is unstable and decomposes to give a carbocation and evolve N_2 gas. The carbocation so formed reacts with water from medium to give further produce alcohol.

76. (d)
reaction with chloroform and alcoholic KOH

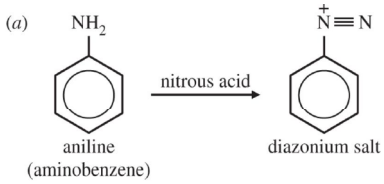
Explanation:
Only primary amines reacts with $CHCl_3$ and alc. KOH to produce foul smelling isocyanide. This test is known as Carbylamine Test (Hoffman's Isocyanide Test) for primary amines

77. (d)
Aromatic primary amines

Explanation:
In Gabriel phthalimide reaction, a potassium salt of phthalimide is formed. It reacts readily with the primary alkyl halide to form the corresponding alkyl derivative. But aryl halide (C_6H_5X) does not react with potassium salt of phthalimide. Because C-X bond in haloarene (alkyl halide) is difficult to be cleaved due to a partial double bond character and hence, do not undergo SN_2 reaction with potassium salt of phthalimide. So, aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis.

78. (b)
diazonium chloride

Explanation:
Aniline reacts with $NaNO_2$ and HCl to produce HNO_2 (nitrous acid). HNO_2 reacts with aniline at low temperature to give benzene diazonium chloride which is stable and the reaction is called diazotization reaction.



79. (b)
Br_2+ NaOH

Explanation:
Conversion of amide to amine having one carbon less is known as Hoffmann bromide reaction.
$RCONH_2 + Br_2 + 4NaOH \rightarrow RNH_2 + Na_2CO_3 + 2NaBr + 2H_2O$

80. (a)
methyl ammonium chloride

Explanation:
Due to the presence of lone pair on nitrogen, methyl amine acts as a Lewis base and reacts with HCl, H^+ ion from HCl forms an adduct (salt) methyl ammonium chloride, $CH_3NH_3^+Cl^-$.

Solution

Class 12 - Mathematics

Multiple Choice Questions Examination

Section A

81. (b)
$x = \sin y + C$

Explanation:
$cosydy = dx$
$\int cosydy = \int dx$
$siny + c = x$

82. (b)
Rs 1648

Explanation:
Here P is the principal at time t
$\frac{dP}{dt} = \frac{5P}{100} \Rightarrow \frac{dP}{dt} = \frac{P}{20}$
$\Rightarrow \int \frac{1}{P} dP = \int \frac{1}{20} dt$
$\Rightarrow \log P = \frac{1}{20} t + \log c$
$\Rightarrow \log \frac{P}{c} = \frac{1}{20} t$
$\Rightarrow P = ce^{\frac{1}{100}}$
When P = 1000 and t = 0 ., then ,
c = 1000, therefore, we have :
$\Rightarrow P = 1000e^{\frac{T}{100}}$
$\Rightarrow A = 1000e^{\frac{5}{10}}$
$\Rightarrow e^{\frac{5}{10}} = A$
$\Rightarrow A = 1000 \log 0.5$
= 1000(1.648)
= 1648

83. (a)
$y(1 + x^2) = log|sinx| + c$

Explanation:
$(1 + x^2)dy = (cotx - 2xy)dx$
$\frac{dy}{dx} = \frac{cotx - 2xy}{1+x^2}$
$\frac{dy}{dx} + \frac{2x}{1+x^2} y = \frac{cotx}{1+x^2}$
It is a linear differential equation in y.
Therefore, Solution is
$ye^{\int \frac{2xdx}{1+x^2}} = \int \frac{cotx}{1+x^2} e^{\int \frac{2xdx}{1+x^2}} dx + c$
$y(1 + x^2) = \int \frac{cotx}{1+x^2} (1 + x^2) dx + c$
$y(1 + x^2) = \int cotx dx + c$
$y(1 + x^2) = log|sinx| + c$

84. (d)
$y = \frac{1}{5}(2\sin x - \cos x) + Ce^{-2x}$

Explanation:

$\frac{dy}{dx} + 2y = \sin x \Rightarrow P = 2, Q = \sin x$
$\Rightarrow I.F. = e^{\int 2dx} = e^{2x}$
$\Rightarrow ye^{2x} = \int \sin x . e^{2x} dx \Rightarrow ye^{2x}$
$= e^{2x} \frac{1}{5}(2\sin x - \cos x) + C$
$\Rightarrow y = \frac{1}{5}(2\sin x - \cos x) + Ce^{-2x}$

85. (c)
6.93%

Explanation:
Let P be the principal at any time t. then,
$\frac{dP}{dt} = \frac{rP}{100} \Rightarrow \frac{dP}{dt} = \frac{P}{100}$
$\Rightarrow \int \frac{1}{P} dP = \int \frac{r}{100} dt$
$\Rightarrow \log P = \frac{r}{100} t + \log c$
$\Rightarrow \log \frac{P}{c} = \frac{r}{100} t$
$\Rightarrow P = ce^{\frac{r}{100}}$
When P = 100 and t = 0., then, c = 100, therefore, we have:
$\Rightarrow P = 100\, e^{r/100}$
Now, let t = T, when P = 100., then;
$\Rightarrow 200 = 100e^{\frac{T}{100}}$
$\Rightarrow e^{\frac{T}{100}} = 2$
$\Rightarrow T = 100 \log 2$ = 100(0.6931) = 6.93%

86. (b)
y" – y'– 6y = 0

Explanation:
$e^{-2x}y = ae^x + b$ dividing by e^{-2x}
$e^{-2x}\frac{dy}{dx} - 2e^{-2x}y = ae^x$.
Dividing by e^x
$e^{-3x}\frac{dy}{dx} - 2e^{-3x}y = a$
$e^{-3x}(\frac{dy}{dx} - 2y) = a$
$e^{-3x}\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3e^{-3x}(\frac{dy}{dx} - 2y) = 0$
$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} - 6y = 0$

87. (b)
Differentiate the function successively as many times as the number of arbitrary constants

Explanation:
We shall differentiate the function equal to the number of arbitrary constant so that we get equations equal to arbitrary constant and then eliminate them to form a differential equation

88. (b)
$y = \frac{1}{x} - \cot x + \frac{C}{x \sin x}$

Explanation:
$\frac{dy}{dx} + (\frac{1}{x} + \cot x)y = 1 \Rightarrow P = \left(\frac{1}{x} + \cot x\right), Q = 1$
$\Rightarrow I.F. = e^{\int \left(\frac{1}{x} + \cot x\right) dx} = e^{\log x + \log \sin x} = e^{\log(x \sin x)} = xsinx$
$\Rightarrow y(x \sin x) = \int 1.x \sin x \Rightarrow xy \sin x = -x \cos x + \sin x + c$
$xysinx = -xcosx + sinx + c$
Dividing by xsinx, we get

$y = -cotx + \frac{1}{x} + \frac{c}{xsinx}$

It is a linear differential equation in y in the form of $\frac{dy}{dx} + Py = Q$hence solution is

$y.IF = \int IF\ Q(x)dx + c$

89. (a)

F(x,y) is a homogeneous function of degree zero

Explanation:

A differential equation of the form y' = F(x,y) is homogeneous if F(x,y) is a homogeneous function of degree zero , so that we can convert it into variable separable form by y=vx.

90. (a)

$\tan^{-1}\left(\frac{y}{x}\right) = \frac{1}{2}\log(x^2 + y^2) + C$

Explanation:

$\frac{dy}{dx} = \frac{x+y}{x-y}$

Put y = vx and $\frac{dy}{dx} = v + x\frac{dv}{dx}$

$\frac{dy}{dx} = \frac{x+y}{x-y} \Rightarrow v + x\frac{dv}{dx} = \frac{1+v}{1-v} \Rightarrow x\frac{dv}{dx} = \frac{1+v^2}{1-v}$

$\Rightarrow \int \frac{1-v}{1+v^2}dv = \int \frac{1}{x}dx \Rightarrow \int \frac{1}{1+v^2}dv - \frac{1}{2}\int \frac{2v}{1+v^2}dv = \int \frac{1}{x}dx$

$\Rightarrow \tan^{-1}v - \frac{1}{2}\log(1+v^2) = \log x + C$

$\Rightarrow \tan^{-1}\left(\frac{y}{x}\right) = \frac{1}{2}\log(x^2 + y^2) + C$

91. (a)

$y + \sqrt{x^2 + y^2} = Cx^2$

Explanation:

$\frac{dy}{dx} = \frac{\sqrt{x^2+y^2}+y}{x}$

Put y=vx, we have ; $\frac{dy}{dx} = v + x\frac{dv}{dx}$

$\Rightarrow v + x\frac{dv}{dx} = \sqrt{1+v^2} + v \Rightarrow \int \frac{1}{\sqrt{1+v^2}}dv = \int \frac{1}{x}dx$

$\Rightarrow \log|\sqrt{1+v^2} + v| = \log|x| + \log C \Rightarrow |\sqrt{1+v^2} + v| = Cx$

$\Rightarrow (y + \sqrt{x^2+y^2})^2 = C^2x^4$

$\Rightarrow (y + \sqrt{x^2+y^2}) = Cx^2$

92. (c)

$y - x + 2 = log\left(x^2(y+2)^2\right)$

Explanation:

$\frac{ydy}{y+2} = \frac{(x+2)dx}{x}$

$\int \frac{ydy}{y+2} = \int \frac{(x+2)dx}{x}$

$\int \frac{y+2-2dy}{y+2} = \int \frac{(x+2)dx}{x}$

$\int dy - \int \frac{2}{y+2} = \int dx + \int \frac{2}{x}$

$y - 2log|y+2| = x + 2log|x| + c$

Here x=1 and y=-1 implies

$-1 - 2log|-1+2| = 1 + 2log|1| + c \implies -1 - 2log|1| = 1 + c \because log|1| = 0 \implies \therefore c = -2$

Hence,

$y - 2log|y+2| = x + 2log|x| - 2$

$y - x + 2 = 2log|x| + 2log|y+2|$

$y - x + 2 = 2log|x(y+2)|$

$y - x + 2 = log|x^2(y+2)^2|$

93. (b)
y" – 2y' + 2y = 0

Explanation:
$e^{-x}y = acosx + bsinx$
$e^{-x}\frac{dy}{dx} - e^{-x}y = -asinx + bcosx$
$e^{-x}(\frac{dy}{dx} - y) = -asinx + bcosx$
$e^{-x}(\frac{d^2y}{dx^2} - \frac{dy}{dx}) - e^{-x}(\frac{dy}{dx} - y) = -acosx - bsinx$
$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$

94. (b)
y = sec x

Explanation:
$\frac{dy}{y} = tanxdx$
$\int \frac{dy}{y} = \int tanxdx$
$log|y| = log|secx| + logc$
$log|y| = log|csecx|$
$y = csecx$
here y=1 and x=0 gives $1 = csec0$
hence c = 1
$\therefore y = secx$

95. (d)
$y^2 - x^2 = 4$

Explanation:
Given that $y\frac{dy}{dx} = x$
$ydy = xdx$
$\int ydy = \int xdx$
$\frac{y^2}{2} = \frac{x^2}{2} + c$
When x = 0 and y = 2, we get
$\frac{-2^2}{2} = \frac{0^2}{2} + c$
c = 2
$\frac{y^2}{2} = \frac{x^2}{2} + 2$
$y^2 - x^2 = 4$

96. (b)
$\frac{1}{3}\left(160\hat{i} - 5\hat{j} - 70\hat{k}\right)$

Explanation:
Let
$\vec{d} = \lambda(\vec{a} \times \vec{b})$,
$\therefore \vec{d} = \lambda\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 4 & 2 \\ 3 & -2 & 7 \end{vmatrix}$
$= \lambda(32\hat{i} - \hat{j} - 14\hat{k})$
Also,$\vec{c}.\vec{d}$ = 15
$\Rightarrow (2\hat{i} - \hat{j} + 4\hat{k}).\lambda(32\hat{i} - \hat{j} - 14\hat{k}) = 15$

$\Rightarrow 9\lambda = 15 \Rightarrow \lambda = \frac{5}{3}$
$\therefore \vec{d} = \frac{5}{3}(32\hat{i} - \hat{j} - 14\hat{k})$
$= \frac{160}{3}\hat{i} - \frac{5}{3}\hat{j} - \frac{70}{3}\hat{k}$

97. (d)
$\frac{1}{2}, \frac{1}{\sqrt{2}}, \frac{1}{2}$

Explanation:
Let, $\overrightarrow{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$, then,
$\Rightarrow a_1^2 + a_2^2 + a_3^2 = 1$.....(1)
$\therefore \vec{a}.\hat{i} = (a_1\hat{i} + a_2\hat{j} + a_3\hat{k}).\hat{i} \Rightarrow |\vec{a}||\hat{i}|cos\frac{\pi}{3} = a_1 \Rightarrow a_1 = \frac{1}{2}$
$\therefore \vec{a}.\hat{j} = (a_1\hat{i} + a_2\hat{j} + a_3\hat{k}).\hat{j} \Rightarrow |\vec{a}||\hat{j}|cos\frac{\pi}{4} = a_2 \Rightarrow a_2 = \frac{1}{\sqrt{2}}$
$\therefore \vec{a}.\hat{k} = (a_1\hat{i} + a_2\hat{j} + a_3\hat{k}).\hat{k} \Rightarrow |\vec{a}||\hat{k}|cos\frac{\pi}{4} = a_3 \Rightarrow a_3 = \cos\theta$
Putting these values in (1) , we get :
$\frac{1}{4} + \frac{1}{2} + cos^2\theta = 1$
$\Rightarrow \frac{3}{4} = 1 - cos^2\theta \Rightarrow sin^2\theta = \frac{3}{4} \Rightarrow sin\theta = \frac{\sqrt{3}}{2} \Rightarrow \theta = 60^o$
$\therefore a_3 = cos60^o = \frac{1}{2}$
$\Rightarrow \vec{a} = \frac{1}{2}\hat{i} + \frac{1}{\sqrt{2}}\hat{j} + \frac{1}{2}\hat{k}$

98. (b)
$-\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$

Explanation:
We have: $\overrightarrow{AB} = -2\hat{i} - 4\hat{j} + 4\hat{k}$
, then, $\hat{AB} = \frac{\overrightarrow{AB}}{|\overrightarrow{AB}|}$
$= \frac{-2\hat{i}-4\hat{j}+4\hat{k}}{\sqrt{(-2)^2+(-4)^2+4^2}}$
$= \frac{-2\hat{i}-4\hat{j}+4\hat{k}}{\sqrt{36}}$
$= \frac{-2\hat{i}}{6} - \frac{4\hat{j}}{6} + \frac{4\hat{k}}{6}$
$= \frac{-1\hat{i}}{3} - \frac{2\hat{j}}{3} + \frac{2\hat{k}}{3}$
Therefore, the D.C.'s of vector AB are given by:
$-\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$

99. (c)
$\frac{\pi}{4}$

Explanation:
We have :
$|\vec{a}.\vec{b}| = |\vec{a} \times \vec{b}|$
$\Rightarrow |\vec{a}||\vec{b}|cos\theta = |\vec{a}||\vec{b}|sin\theta$
$\Rightarrow cos\theta = \sin\theta$
$\Rightarrow tan\theta = 1 \Rightarrow \theta = \frac{\pi}{4}$

100. (a)
$\pm\frac{2}{3}\hat{i} \mp \frac{2}{3}\hat{j} \mp \frac{1}{3}\hat{k}$

Explanation:

It is given that:
$\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$
$\therefore \vec{a} + \vec{b} = 4\hat{i} + 4\hat{j}$ and $\vec{a} - \vec{b} = 2\hat{i} + 4\hat{k}$
$\therefore (\vec{a} + \vec{b}) \times (\vec{a} - \vec{b}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & 4 & 0 \\ 2 & 0 & 4 \end{vmatrix} = 16\hat{i} - 16\hat{j} - 8\hat{k}$
$\therefore |(\vec{a} + \vec{b}) \times (\vec{a} - \vec{b})| = \sqrt{576} = 24$
Therefore, the unit vector perpendicular to both the vectors $(\vec{a} + \vec{b})$
and
$(\vec{a} - \vec{b})$ is given by:
$= \pm\frac{(16\hat{i} - 16\hat{j} - 8\hat{k})}{24} = \pm\frac{1}{3}(2\hat{i} - 2\hat{j} - \hat{k})$.

101. (b)
2

Explanation:
We have:
$\overrightarrow{OA} = -\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}$(position vector of A) similarly , $\overrightarrow{OB} = \hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}$, $\overrightarrow{OC} = \hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}$, $\overrightarrow{OD} = -\hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}$:
,where $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \left(\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}\right) - \left(-\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}\right) = 2\hat{i} + 0\hat{j} + 0\hat{k}$(by triangle law of vector addition),similarly $\overrightarrow{AD} = 0\hat{i} - \hat{j} + 0\hat{k}$, Therefore , area of rectangle ABCD is given by $\left|\overrightarrow{AB} X \overrightarrow{AD}\right|$,where$\overrightarrow{AB} X \overrightarrow{AD} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 0 & 0 \\ 0 & -1 & 0 \end{vmatrix} = \hat{i}(0-0) - \hat{j}(0-0) + \hat{k}(-2-0)$=$-2\hat{k}$, $\left|\overrightarrow{AB} X \overrightarrow{AD}\right|$= $\sqrt{0^2 + 0^2 + (-2)^2} = 2$ sq. units.

102. (a)
$\frac{\pi}{4}$

Explanation:
It is given that $\vec{a} \times \vec{b}$ is a unit vector, then:
$\Rightarrow |\vec{a} \times \vec{b}| = 1 \Rightarrow |\vec{a}||\vec{b}| sin\theta = 1$
$\Rightarrow 3.\frac{\sqrt{2}}{3} sin\theta = 1 \Rightarrow sin\theta = \frac{1}{\sqrt{2}} \Rightarrow \theta = \frac{\pi}{4}$

103. (a)
$\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = 0$

Explanation:
$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}$ (triangle law of vector addition) but $\overrightarrow{AC} = -\overrightarrow{CA}$

104. (d)
$\cos^{-1}\left(\frac{10}{\sqrt{102}}\right)$

Explanation:
Position vectors of the points A , B and C are $\hat{i} + 2\hat{j} + 3\hat{k}, -\hat{i}, and, \hat{j} + 2\hat{k}$ respectively.
Then;

$cos\theta = \frac{\vec{BA}.\vec{BC}}{|\vec{BA}||\vec{BC}|}$

$= \frac{(2\hat{i}+2\hat{j}+3\hat{k}).(\hat{i}+\hat{j}+2\hat{k})}{\sqrt{17}\sqrt{6}}$

$\Rightarrow cos\theta = \frac{10}{\sqrt{102}}$

$\Rightarrow \angle ABC = cos^{-1}(\frac{10}{\sqrt{102}})$

105. (d)

$\frac{\sqrt{61}}{2}$

Explanation:

Given position vector of A ,$\overrightarrow{OA} = \hat{i}+\hat{j}+2\hat{k}$ positionvector of B,$\overrightarrow{OB} = 2\hat{i}+3\hat{j}+5\hat{k}$ and that of C, $\overrightarrow{OC} = \hat{i}+\hat{j}+5\hat{k}$ therefore,$\overrightarrow{AB} = \overrightarrow{OB}-\overrightarrow{OA} = \left(2\hat{i}+3\hat{j}+5\hat{k}\right)-\left(\hat{i}+\hat{j}+2\hat{k}\right) = \hat{i}+2\hat{j}+3\hat{k}$ (by triangle law of vector addition) thus we may write

$\vec{AB} = \hat{i}+2\hat{j}+3\hat{k}, \vec{AC} = 4\hat{j}+3\hat{k},$

$\therefore \overrightarrow{AB}\times\overrightarrow{AC} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 3 \\ 0 & 4 & 3 \end{vmatrix} = -6\hat{i}-3\hat{j}+4\hat{k}$

$\Rightarrow |\overrightarrow{AB}\times\vec{AC}| = \sqrt{61}$

$\Rightarrow \frac{1}{2}|\overrightarrow{AB}\times\vec{AC}| = \frac{1}{2}\sqrt{61}$

Therefore, the area of triangle ABC is $=\frac{1}{2}\sqrt{61}$

106. (a)

$\lambda = 1$

Explanation:

Let $\vec{a} = \hat{i}+\hat{j}+\hat{k}, \vec{b} = 2\hat{i}+4\hat{j}-5\hat{k}$ and $\vec{c} = \lambda\hat{i}+2\hat{j}+3\hat{k},$

$\vec{b}+\vec{c} = (\lambda+2)\hat{i}+6\hat{j}-2\hat{k}$

$\Rightarrow |\vec{b}+\vec{c}| = \sqrt{(\lambda+2)^2+40}$

Therefore, a unit vector along

$\vec{b}+\vec{c}$ is given by:

$\frac{\vec{b}+\vec{c}}{|\vec{b}+\vec{c}|} = \frac{(\lambda+2)\hat{i}+6\hat{j}-2\hat{k}}{\sqrt{(\lambda+2)^2+40}} = 1$

Also, scalar product of $\hat{i}+\hat{j}+\hat{k}$ with above unit vector is 1.

$\therefore (\hat{i}+\hat{j}+\hat{k}).\frac{(\lambda+2)\hat{i}+6\hat{j}-2\hat{k}}{\sqrt{(\lambda+2)^2+40}} = 1$

$\Rightarrow (\lambda+6)^2 = (\lambda+2)^2+40 \Rightarrow \lambda = 1$

107. (b)

$\vec{a} = \frac{1}{\sqrt{6}}\hat{i}+\frac{1}{\sqrt{6}}\hat{j}+\frac{2}{\sqrt{6}}\hat{k}$

Explanation:

We have :

$vector\,\vec{a} = \hat{i}+\hat{j}+2\hat{k},$

$\widehat{a} = \frac{\vec{a}}{|\vec{a}|} = \frac{\hat{i}+\hat{j}+2\hat{k}}{\sqrt{1^2+1^2+2^2}} = \frac{\hat{i}+\hat{j}+2\hat{k}}{\sqrt{6}} = \frac{\hat{i}}{\sqrt{6}}+\frac{\hat{j}}{\sqrt{6}}+\frac{2\hat{k}}{\sqrt{6}}$

108. (b)

3, $\frac{27}{2}$

Explanation:
It is given that:
$\left(2\hat{i}+6\hat{j}+27\hat{k}\right) X \left(\hat{i}+\lambda\hat{j}+\mu\hat{k}\right) = \vec{0}$
$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 6 & 27 \\ 1 & \lambda & \mu \end{vmatrix} = \hat{i}(6\mu - 27\lambda) - \hat{j}(2\mu - 27) + \hat{k}(2\lambda - 6) = \vec{0}$, equating the coefficients of $\hat{i}, \hat{j}, \hat{k}$on both sides,we get $(6\mu - 27\lambda) = 0, (2\mu - 27) = 0, (2\lambda - 6) = 0.$
solving,we get $\lambda = 3, \mu = \frac{27}{2}$

109. (c)
2 : 3

Explanation:
$\overrightarrow{AB} = 4\hat{i}+2\hat{j}+6\hat{k} = 2\left(2\hat{i}+\hat{j}+3\hat{k}\right)$
$\overrightarrow{BC} = 6\hat{i}+3\hat{j}+9\hat{k} = 3(2\hat{i}+\hat{j}+3\hat{k})$
$\therefore \overrightarrow{AB} = 2 \times \frac{\overrightarrow{BC}}{3}$

Therefore , AB and BC are parallel, but point B is common , so points , A,B,C are collinear. As $\frac{\overrightarrow{AB}}{\overrightarrow{BC}} = \frac{2}{3}$, thus , point B divides AC in the ratio 2 : 3.

110. (b)
8

Explanation:
If $\vec{a} = 2\hat{i}+2\hat{j}+3\hat{k}, \vec{b} = -\hat{i}+2\hat{j}+\hat{k}\ and\ \vec{c} = 3\hat{i}+\hat{j}$
are such that $\vec{a}+\lambda\vec{b}$is perpendicular to $\vec{c}, then (\vec{a}+\lambda\vec{b}).\vec{c} = 0.$
$[(2\hat{i}+2\hat{j}+3\hat{k})+\lambda(-\hat{i}+2\hat{j}+\hat{k})].(3\hat{i}+\hat{j}) = 0$
$\Rightarrow [(2-\lambda)\hat{i}+(2+2\lambda)\hat{j}+(3+\lambda)\hat{k}].(3\hat{i}+\hat{j}) = 0$
$\Rightarrow 6-3\lambda+2+2\lambda = 0 \Rightarrow \lambda = 8$

111. (a)
Z has no maximum value

Explanation:
Objective function is Z = - x + 2 y .....(1).
The given constraints are : x ≥ 3, x + y ≥ 5, x + 2y ≥ 6, y ≥ 0.

Corner points	Z = - x + 2y
D(6,0)	-6
A(4,1)	-2
B(3,2)	1

Here, the open half plane has points in common with the feasible region.
Therefore, Z has no maximum value.

112. (c)
2500

Explanation:
Here , Maximize Z = 50x+60y , subject to constraints x +2 y ≤ 50 , x + y ≥ 30, x, y ≥ 0.

Corner points	Z = 50x +60 y
P(50 ,0)	2500
Q(0 , 30)	1800
R(10, 20)	1700

Hence, the maximum value is 2500

113. (a)
1020

Explanation:
Here , Maximize Z = 5x+3y , subject to constraints $x + y \leq 300$, $2x + y \leq 360$, $x \geq 0$, $y \geq 0$.

Corner points	Z = 5x +3 y
P(0 ,300)	900
Q(180 , 0)	900
R(60, 240)	1020.....(Max.)
S(0 , 0)	0

Hence, the maximum value is 1020

114. (b)
196

Explanation:
Here , maximize Z = 3x+4y ,

Corner points	**Z = 3x + 4 y**
C(0 ,38)	132
B (52 ,0)	156
D(44 , 16)	196

Hence the maximum value is 196

115 d) 116 b) 117 b) 118 c) 119 b) 120 b)
