



UNIFIED COUNCIL

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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION - 2011

SOLUTIONS FOR CLASS : 12-PCB

Biology

1. (D) In a flower fertilisation takes place in ovary.
2. (D) Thin leaves with a large surface area are not suitable to the hot and dry climate.
3. (B) Anatropous ovule.
4. (B) Basal body of the sperms flagellum divides and forms into two centrosomes.
5. (C) Sex of a baby is determined by father's chromosomes. XY denotes male boy.
6. (B) In honey bees quality of food determines a diploid larva to become a fertile queen or a sterile worker female.
7. (C) The given diagram shows a symbiotic (Mutualistic) relationship in lich.
8. (B) Down's syndrome ($45 + \times \times$ or $45 + xy$) is the case when there is one extra chromosome on 21st pair of autosome numerical abnormalities in autosomes.
9. (C) The arrow in the given figure points to protein layer it protects the nucleic acid.
10. (C) The ability to adapt to the environment in the niche it occupies is called natural selection.
11. (C) The gamete are identical : Isogamous.
Differ in size : Anisogamous
Micro gamete is motile
& Macro is non-motile : Oogamous
12. (C) IV, I, II, V, III.
13. (C) Aspergillus niger is used for production of citric acid in industries.
14. (B) The graph given below represents J shaped growth curve of lemmings.
15. (C) Gametogenesis \rightarrow syngamy \rightarrow zygote \rightarrow embryogenesis
16. (D) Fertilisation of gametes lead to the formation a zygote. After the first division of the zygote the sex of a baby is determined the presence of (XX)
17. (B) chromosomes determine the sex of a baby.
17. (B) The breakdown of the elastic tissues in the alveoli is due to emphysema.
18. (B) Griffith's for the first time, reported transformation in bacteria.
19. (A) Plasmodium (Malarial parasite) is a erythrocytic parasite, hence RBC's are examined.
20. (C) Grasshopper and cattle are herbivores. They are called primary consumers.
21. (C) PCR is a technique in which a small fragment of DNA is rapidly cloned or duplicated to produce multiple DNA copies.
22. (B) Heat energy is not recycled in the ecosystem.
23. (C) Restriction enzymes are also known as molecular scissors or molecular knives. They are isolated from bacteria. They recognise specific base sequence in DNA and cleave both strands of it.
24. (B) For starting translation starting codon AUG is must. The termination condon (UAA, UAG are UGA). Must be at the end.
25. (A) Leucaena leucocephala is commonly known as subabool. It is a very fast growing leguminous plant and therefore is commonly used as social forestry plant.
26. (D) The given figure represents oxygen cycle.
27. (B) Decomposers release different enzymes from their bodies into the dead and decaying plant and animal remains, lead to the release of simple inorganic substances.
28. (A) In a testcross a heterozygous offspring is crossed with homozygous recessive parent.
29. (C) Scales and claws of integumentary structures characterize birds as glorified reptiles because the presence of scales and claws is the important feature of reptiles.
30. (C) Inversion
31. (C) According to Chargaff's rules double stranded DNA consists of $A = T$ and $G = C$. In problem $C = 18\%$ so $G =$ will be 18% as $G + C$ rest 64% contains 'A' and 'T' would

be 64% i.e., $A = T$ which would participate $A = 32\%$ and $T = 32\%$.

32. (C) 10% law of energy transformation was given by Lindemann.
33. (C) Carbon monoxide combines with haemoglobin 200 times faster than oxygen. Thus it prevents the absorption of oxygen with haemoglobin and causes respiratory disease.
34. (B) As the earth is cooled, free atoms in the atmosphere formed inorganic molecules including H_2O and NH_3 which interacted to form nucleic acids, proteins and sugars.
35. (D) Each microspore mother cell divides meiotically to form 4 pollen grains ($4 \times 4 = 16$).
36. (D) Malaria is caused by a protozoan.
37. (B) Biological control is the use of living organisms like natural predators and parasites to control pest population.
38. (A) Biogenetic law was proposed by Ernst Haeckel. It states that an organism during its development (ontogeny) tends to repeat the evolutionary history (phylogeny) of its ancestors.
39. (B) Insectivorous plants can survive in N_2 deficient soil as they trap N_2 from the insect.
40. (A) Neopalina is a connecting link between annelids and molluscs.

Physics

41. (C) The total electric flux coming out of the cube is zero. As the dipoles are placed inside the cube and the electric field inside, a body is zero (According to Gauss law). The total electric flux is zero when the electric field is zero.
42. (D) The strength of an electromagnet depends on the voltage applied and the number of turns of the coil. In option (D), the electromagnet has high voltage applied with more number of turns than other electromagnets in options A, B and C.
43. (C) The earth's atmosphere is transparent to visible light and radio waves, but absorbs X-rays. Therefore, X-ray astronomy is possible only from satellites orbiting the earth.
44. (B) In a step-up transformer, $V_o > V_i$, same period and V_o is not 180° out of phase with V_i . So option (B) satisfies these conditions.
45. (C) Critical angle for the liquid-air surface is

$$1.6 \sin C = 1$$

$$\Rightarrow \sin C = \frac{1}{1.6} = 0.625$$

$$\sin i = 0.7$$

$\therefore i > C$, hence ray will be internally reflected.

46. (B) Let I_1 be the current through $6\ \Omega$ resistance I_2 through $(9 + 3)\ \Omega$ resistance.

$$I_1^2 \times 6 = 24$$

$$I_1 = 2\text{ A}$$

$$\text{P.D. across C and D} = 2 \times 6 = 12\text{ V}$$

$$\text{Current } I_2 = \frac{12}{9+3} = 1\text{ A}$$

$$\therefore \text{Total current } I \text{ through } 2\ \Omega = (2 + 1) = 3\text{ A}$$

Heat produced per second in $2\ \Omega$

$$= I^2 R = 3^2 \times 2 = 18\text{ cal s}^{-1}$$

47. (B) Mass of ${}_6C^{12}$ mass of neutron

$$= \text{total mass of } {}_6C^{13}$$

$$= 12 + 1.00867 = 13.00867\text{ U}$$

$$\text{Atomic mass of } {}_6C^{13} = 13.00335\text{ U}$$

$$\text{Mass defect} = 13.00867 - 13.00335 = 0.0532\text{ U}$$

$$\begin{aligned} \text{B.E. of least bound neutron in a } {}_6C^{13} \text{ nucleus (in MeV)} &= 0.0532 \times 931 \\ &= 4.953\text{ MeV} \end{aligned}$$

48. (D) NAND gate is also called as universal gate as it can be used to construct any kind of gate. Hence, forms a base for the digital circuits.

49. (B) In Fresnel diffraction, the ray from source is not parallel to the screen, while both source and screen are near the aperture. But in Fraunhofer diffraction both light source and screen are very far from the aperture and ray incident on the aperture and ray leaving the aperture are parallel.

50. (A) Pulse code modulation uses digital signals for modulating the information signals.

$$\frac{2E}{4+2r} = \frac{E}{4+\frac{r}{2}}$$

51. (B) Here, I series

$$8 + r = 4 + 2r$$

$$r = 4\ \Omega$$

52. (A) The shortest wavelength of X-rays photon is given by:

$$\lambda_0 = \frac{hc}{eV}$$

$$= \frac{(6.6 \times 10^{-34}\text{ Js})(3.0 \times 10^8\text{ m/sec})}{(1.6 \times 10^{-19}\text{ C})(5.0 \times 10^4\text{ V})}$$

$$= 2.5 \times 10^{-11}\text{ m}$$

53. (C) D.C. is blocked by a capacitor. So, bulb does not light up when energy source is dc for circuit in option (C).

54. (A) Here, $8 \times \frac{4}{3} \pi (r)^3 = \frac{4}{3} \pi R^3$

$$r = 1 \text{ mm}$$

or $R = 2r = 2 \text{ mm}$

$$V = \frac{1}{4\pi\epsilon_0} \frac{Q}{R} = \frac{9 \times 10^9 \times 8 \times 0.066 \times 10^{-12}}{2 \times 10^{-3}}$$

$$= 2.4 \text{ volts}$$

55. (B) Given $M = 30$ i.e. $\frac{I_c}{I_b} = 30$

$$I_e = I_b + I_c$$

Divide the equation by I_b

$$\frac{I_e}{I_b} = 1 + \frac{I_c}{I_b} = 1 + 30 = \frac{31}{1} \text{ (or) } 31 : 1$$

56. (C) $I \propto A^2$ (A = amplitude)

$$\frac{I_1}{I_2} = \frac{9}{1}$$

$$\Rightarrow \frac{A_1}{A_2} = \sqrt{\frac{I_1}{I_2}} = 3$$

$$\Rightarrow \frac{A_1 + A_2}{A_1 - A_2} = \frac{4}{2} = \frac{2}{1}$$

$$\frac{I_{\max}}{I_{\min}} = \frac{(A_1 + A_2)^2}{(A_1 - A_2)^2} = 4 : 1$$

57. (A) Under minimum deviation condition,

$$\mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

If $\delta_m = A$, then

$$\Rightarrow \mu = \frac{\sin\left(\frac{A + A}{2}\right)}{\sin\frac{A}{2}} = \frac{\sin A}{\sin\frac{A}{2}} = 2\cos\frac{A}{2}$$

$$A = 2\cos^{-1}\left(\frac{\mu}{2}\right)$$

58. (B) At night in the absence of suns radiation no ionisation can take place. Moreover, the recombination of ions takes place. Hence, the E-layer of the ionosphere disappears at night.

59. (C) Field produced by X and Z at position of Y is:

$$B_Y = B_X - B_Z = \frac{\mu_0 \times 3}{2\pi \times 3 \times 10^{-2}} - \frac{\mu_0 \times 2}{2\pi \times 4 \times 10^{-2}}$$

$$= 10^{-5} \text{ T}$$

$$F = B_Y il \sin 90^\circ$$

$$= 10^{-5} \times 1 \times 0.5$$

$$= 5 \times 10^{-6} \text{ N}$$

Since B_Y is perpendicular to plane of paper and downwards, hence, it acts left to right.

60. (A) According to Maxwell's hypothesis, an accelerated charge produces a sinusoidal time varying magnetic field, which in turn produces a sinusoidal time varying electric field. The two fields so produced are mutually perpendicular and are sources at each other.

61. (B) We have $u = f + x$ and $v = f + y$

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = \frac{1}{f+x} + \frac{1}{f+y}$$

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

$$(f+x)(f+y) = f(2f+x+y)$$

$$f^2 + fx + fy + xy = 2f^2 + fx + fy$$

$$xy = f^2$$

62. (D) $R_1 = 5R$

$$R_2 = R + R + R = 3R$$

A balanced wheatstone bridge is in series with two resistance R and R .

$$\therefore \frac{R_2}{R_1} = \frac{3R}{5R} = 3 : 5$$

63. (B) Since the two capacitors by K_1 and K_2 are in parallel, therefore

$$C_P = C_1 + C_2$$

$$= \frac{\epsilon_0 AK_1}{2t} + \frac{\epsilon_0 AK_2}{2t}$$

$$= \frac{\epsilon_0 A}{2t} (K_1 + K_2)$$

64. (A) $Bil = mg$

$$B \times 9.8 \times 1 = 13 \times 10^{-3} \times 9.8$$

$$B = 3 \times 10^{-3} \text{ T}$$

65. (C) A zener can operate either in forward or reverse biased condition. When zener breakdown occurs the applied voltage is greater than zener breakdown voltage. The current in the zener region is in

opposite direction to that of the forward biased diode. Zener diode cannot be used as a half wave rectifier.

Chemistry

66. (C) Contribution of A atoms in the corner

$$= \frac{1}{8} \times 7 = \frac{7}{8}$$

Contribution of B atoms the face centre

$$= 6 \times \frac{1}{2} = 3$$

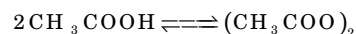
The formulae = $A \frac{7}{8} B_3 = A_7 B_{24}$

67. (C) i) Due to missing of an atom in the unit cell leads to Frenkel defect.

ii) In metal excess defects, A negative ion may be missing from its lattice site leaving a 'hole' which is occupied by an extra electron to maintain the electrical neutrality. The anionic site, occupied by an electron is called F-centres.

68. (A) $\Delta T = \frac{1000 \times k_f \times w}{M \cdot wt \times W}$

$$0.45 = \frac{1000 \times 5.12 \times 0.2}{20 \times M \cdot wt} \Rightarrow M \cdot wt = 113.8$$



Before association 1 0

After association 1 - α $\frac{\alpha}{2}$

$$\frac{m_{(Normal)}}{m_{(Observed)}} = 1 - \alpha + \frac{\alpha}{2}$$

$$= \frac{60}{113.8} = 1 - \alpha + \frac{\alpha}{2} \Rightarrow \alpha = 0.945$$

69. (B) Reducing agent means tendency to oxidise; Among the elements Zn possess less reduction potential value. Hence it is a strong reducing agent.

70. (B) $K = Cx \frac{1}{a}$

$$\frac{1}{a} = \frac{k}{c} = 0.0212 \times R$$

$$= 0.0212 \times 55$$

$$= 1.166 \text{ cm}^{-1}$$

71. (D) In 1 hour decrease in conc. of

$$A = \frac{0.6 - 0.5}{1} = 0.1$$

In 1 hour increase in conc. of

$$B = \frac{0.2 - 0}{1} = 0.2$$

(i) 0.1 mole A gives 0.2 mole B in a given time thus, $n = 2$

$$(ii) K_c = \frac{[B]^n}{[A]} = \frac{(0.6)^2}{0.3} = 1.2 \text{ mole/lit.}$$

72. (C) For a first order reaction :

$$-2.303 \log(a - x) = Kt - 2.303 \log a$$

$$\log(a - x) = \frac{-K}{2.303} t + \log a$$

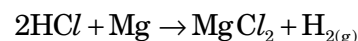
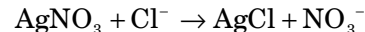
$$\text{slope} = \frac{-K}{2.303}$$

73. (A) Physical adsorption is inversely proportional to temperature because physical adsorption decreases as the temperature increases. Hence, the graph

between $\frac{x}{m}$ versus temperature is a rectangular hyperbola.

74. (B) The formation of Carbon monoxide from carbon can reduce the metal oxide to metal at a temperature of the point of intersection of the two lines. In the given figure the temperature 200.

75. (C) $Cl_2 + H_2O \rightarrow HCl + HClO$



76. (C) The compound is Aspirin, which is used as analgesic.

77. (A) Higher the Electronegativity of the halogen atom, greater is the acid strength of the acid.

78. (C) A, B, D are the correct uses of the helium but helium is not used in the preparation of super conducting magnets.

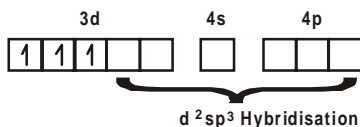
79. (D) In $S_2O_7^{2-}$; S - O - S bond is present.

80. (D) $2MnO_4^- + 6H^+ + 5(COOH)_2 \rightarrow 2Mn^{+2} + 10CO_2 + 8H_2O$
The Mn^{+2} ions that are formed in the above reaction acts as catalyst and enhances the rate of reaction.

81. (D) $[Pt(NH_3)_6]Cl_4 \rightleftharpoons [Pt(NH_3)_6]^{4+} + 4Cl^-$

Hence, $[Pt(NH_3)_6]Cl_4$ is a complex compound that furnishes ions in solution while $[PtCl_2(NH_3)_2]$ does not furnish ions in solution. So, $[Pt(NH_3)_6]Cl_4$ is an electrical conducting medium in aqueous solution.

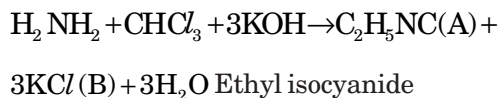
82. (C) EC of Cr^{+3} in ground state:



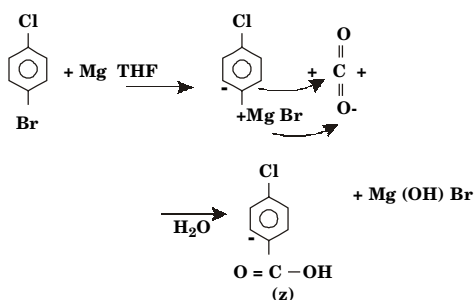
$$\mu = \sqrt{n(n+2)}$$

$$= \sqrt{3(3+2)} = \sqrt{15} = 3.87 \text{ BM}$$

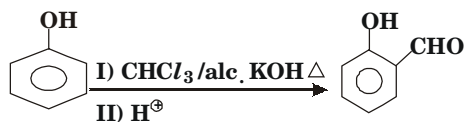
83. (A)



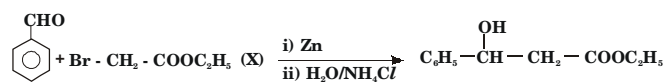
84. (A)



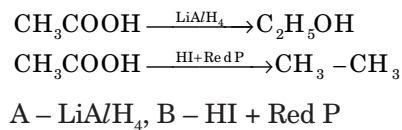
85. (D) Reimer - Tiemann reaction :



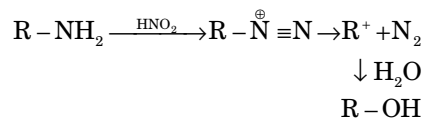
86. (C)



87. (D)



88. (C)



89. (B) The linkage between two glucose moities in amylose is α , and the linkage between two glucose moities in cellulose is β .

90. (D) $\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}-\text{COOH} \\ | \\ \text{NH}_2 \end{array}$ The central carbon is not a symmetric.
Glycine is an optically inactive amino acid.