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IOM

Model Entrance Exam

2075

Morning Shift

(Set-XIII A)

Date: 2075/04/26

Hints and Solutions

Physics

1. c) For uniformly accelerated motion, $S = ut + \frac{1}{2}at^2$

   If motion starts from rest, $u = 0 \Rightarrow S = \frac{1}{2}at^2 \Rightarrow S \propto t^2$

2. c) $\because P = \sqrt{2mE} \Rightarrow E = \frac{P^2}{2m} = \frac{(50)^2}{2 \times 10} = 125$ J

3. a) At earth's centre, $g = 0 \Rightarrow W = mg = 0$

4. d) $1000 \times \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3 \Rightarrow R^3 = 1000\, r^3 = (10r)^3 \Rightarrow R = 10\, r \Rightarrow r = \frac{R}{10}$

5. a) For an isothermal process,

   $P_1V_1 = P_2V_2 \Rightarrow P_2 = P_1\left(\frac{V_1}{V_2}\right) = 1 \times \left(\frac{V}{\frac{V}{4}}\right) = 4$ atm

6. d) $\because E \propto T^4$

   $\frac{E_2}{E_1} = \left(\frac{T_2}{T_1}\right)^4 = \left(\frac{273 + 273}{0 + 273}\right)^4 = 2^4 = 16 \;\; \therefore \;\; E_2 = 16E = 16\,E$

7. c) 4.2 J = 1 cal

   420 J = 100 cal

   $\because Q = ms\Delta\theta$

   $100 = 10 \times 1\Delta\theta \Rightarrow \Delta\theta = 10^oC$

8. d) For spherical mirror, $f = \frac{R}{2}$ (independent with colour)

9. a) $\mu = \frac{\sin\left(\frac{A + D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin\left(\frac{60^o + 30^o}{2}\right)}{\sin\left(\frac{60^o}{2}\right)} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{2}} = \sqrt{2}$

10. b) $\because \beta = \frac{\lambda D}{d}$ for red light, λ is maximum.

11. a) Work done on equipotential surface (path) is zero.

12. a) In series, charge on each capacitor remains same. $\therefore \frac{q_1}{q_2} = \frac{1}{1}$

13. a)

14. c) Magnetic force is always perpendicular to instantaneous path of the particle.

15. a) In parallel, heat produced $H = \frac{V^2}{R}t \propto \frac{1}{R}$. Hence, smaller is resistance, more is the heat produced.

16. c) comparing with y = a sin (kx – wt)

$w = 2\pi$ or $2\pi f = 2\pi \Rightarrow f = 1$ Hz

17. a) $S \rightarrow O_{rest}$

$$f' = \left(\frac{V}{v - v_s}\right) f = \left(\frac{V}{v - \frac{v}{10}}\right) f = \frac{10}{9} f$$

$$\Rightarrow \frac{f'}{f} = \frac{10}{9}$$

18. a) $\lambda = \frac{h}{\sqrt{2mE}}$ for same kinetic energy, $\lambda \propto \frac{1}{\sqrt{m}}$

As the mass of electron is smaller, λ is larger for it.

19. b) Second member of Lyman series has more energy than first member.

20. b) $N = N_0 - \frac{15}{16} N_0 = \frac{N_0}{2^4}$

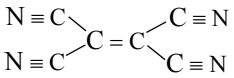
$\frac{N}{N_0} = \frac{1}{2^4}$ ..... (i)

Also, $\frac{N}{N_0} = \frac{1}{2^n}$ ..... (ii)

On comparing these, n = 4, t = 2 hrs = 120 min.

$\therefore T_{1/2} = \frac{t}{n} = \frac{120}{4} = 30$ min

Chemistry

21. a) Count σ - and π-bonds in 

22. c) $2KClO_3 \longrightarrow 2KCl + 3O_2\uparrow$;

245g $KClO_3$ on heating shows a wt. loss = 96g (of O_2)

$\therefore$ 100g $KClO_3$ on heating shows a wt. loss = $\frac{96 \times 100}{245}$ g = 39.18%

23. a) 2 mole of H_2O = 36g H_2O = 2N molecules.

24. d) $2e + S^{6+} \longrightarrow S^{4+}$

S of H_2SO_4 is reduced.

25. b) $w = \frac{E.Q}{96500} = \frac{108 \times 9650}{96500} = 10.8$ g

26. a) K is lighter than Na.

27. d) Calcinations involves decomposition of ore to remove volatile impurities.

28. d) The steps involved in extraction of copper from pyrites ($CuFeS_2$) involves concentration, roasting, smelting, bessemerisation and electrolytic refining. Up to bessemerisation 98% blister copper is obtained and after electrolytic refining 99.5% pure copper is obtained.

29. d) $SO_2 + 2HNO_2 \longrightarrow H_2SO_4 + 2NO$.

30. a) Most abundant element is oxygen on earth crust.

31. d)

32. d) E^o_{OP} for Cr^{2+}/Cr^{3+} is maximum + 0.41 V and thus Cr^{2+} will be easily oxidised to Cr^{3+}.

33. d) Rest all are colloidal solutions. Scattering of light by colloidal particles is Tyndall effect.

34. b) For I order, reaction

$\log(a - x) = \log a - \frac{Kt}{2.303}$

$y = c + mx$

35. a) $K_C = \frac{[C_6H_6]}{[C_2H_2]^3}$ or $4 = \frac{[C_6H_6]}{(0.5)^3} \therefore [C_6H_6] = 0.5$ M

36. c) Meq. of HCl = 40 × 0.1 = 4

Meq. of NaOH = 10 × 0.45 = 4.5

$\therefore$ Meq. of NaOH left = 0.5

Now, $[OH^+] = \frac{0.5}{50} = 10^{-2}$

$\therefore$ pOH = 2 and pH = 12

37. b) Heat change for 3.6g $H_2O = \frac{68 \times 3.6}{18} = 13.6$ kcal

38. a) $v_{rms} \propto \sqrt{\left[\frac{1}{M}\right]}$ at STP

39. d) These are limitations of Bohr's model.

40. b) $n = 4$, $l = 3$ means 4*f*, since $l = 3$ for *f*-subshell.

41. b) Equate at. no. and mass no.

42. a)

Group	Nature	Directive Influence
$-CH_3$, –Cl	Saturated	o – and p directing
–CN, – CHO	unsaturated	Meta Directing
$-COO^-$, $-N \overset{\rightarrow}{=} C$, –CH=CH–COOH	unsaturated	o,p–directing
$-CCl_3$, $-NH_3^+$	saturated	m-directing

43. b) $LiAlH_4$ reduces – COOH to – CH_2OH but does not influence C = C.

44. b) Kharasch effect is peroxide effect but all peroxide effects are not Kharasch effect. Kharasch effect is peroxide effect with HBr but

peroxide effect may be shown by $CHCl_3$, CCl_4, CCl_3Br, CBr_3Cl with free radical initiator.

$$CH_3CH_2–CH = CH_2 + HBr \xrightarrow[\text{Anti-Markovnikov's rule}]{\text{Peroxide}} CH_3CH_2–CH_2CH_2Br$$

45. b) benzene + $Cl_2 \xrightarrow{\text{uv light}}$ Benzene hexachloride (BHC) or Lindane or Gammaxane or 666

46. a) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \rightleftharpoons CH_2=\overset{\overset{OH}{|}}{C}-CH_3$

Keto form Enol form

Hence, In enolic form, total σ bonds = 9; total π bonds = 1 and lone pair of electrons = 2.

47. d) Phenol is least acidic and the acidic strength order is:

p– nitrophenol > o- nitrophenol > m – nitrophenol > phenol.

48. a) $\begin{matrix} a \\ a \end{matrix}\!\!>\!C=C\!<\!\!\begin{matrix} a \\ a \end{matrix}$ does not show geometrical isomerism.

49. d) When hemi-acetal reacts with alcohol it gives acetal.

50. a) Polymers formed by only one type of monomer units is known as homopolymers. Polymers formed by two or more type of monomers are known as copolymer.

Botany

51 c) Some virus may contain RNA as genetic material which indicates that RNA can act as carrier of heredity information as DNA.

52 b) Iodine, Bromine and sulphur are commercially produced from different species of Brown algae like Laminaria, Macrocystis, Sargassum, etc.

53 d) The plant with embryos, spores and without seeds and vascular tissues belongs to Bryophytes (Riccia).

54 d) Seed is produced or established from Gymnosperms while seed habit is originated from Pteridophytes. The heterospory of Selaginella is considered as origin point of seed habit.

55 a) Gymnosperms (Cycads) does not require water for fertilization hence also considered as complete land plant. Bryophytes and Pteridophytes are land plants but require water for fertilization (amphibian).

56 b) Scales are concentric in tunicated bulb as in onion and garlic (not in scaly bulb as in lily). The scaly bulb has partial covering and called scales.

57 c) Sorosis is multiple fruit produced from complete inflorescence like spike, catkin and spadix.

58 c) Asteraceae has ligulate (ray floret) and tubular (disc florets) flowers. Ray floret is unisexual flower with 2-5 free pappus, pentamerous, zygomorphic with bicarpellary ovary.

59 c) Bicollateral vascular bundle has two phloem patches on either side of central xylem separated by cambium.

60 b) Marine organisms have hyper concentration of solutes. When it is placed in fresh water, the organism will start to gain water molecule due to endosmosis and burst.

61 c) Krebs cycle starts with Acetyl CoA which, combine with Oxaloacetic acid and produce Citric acid and first metabolite.

62 b) The universal outermost layer of cell is cell membrane or plasma membrane. In plants, fungi and bacteria, the cell membrane is again encircled by rigid cell wall.

63 b) The pairing of homologous chromosome during zygotene is called synapsis.

64 b) The concentration of Magnesium ion (Mg++) is responsible for association and dissociation of ribosomal units.

65 a) For distinct visibility, the night blooming flower should be white coloured

66 a) The action spectrum of photosynthesis (after white light) is red > blue > yellow > green.

67 c) The mature pollen grain is also called male gametophyte which bears two male gametes.

68 b) Ultimate source of energy for every life is obtained from producers through photosynthesis which require solar radiation.

69 a) For organs transplantation, antigen-antibody reaction should be prevented. Every external factor is treated as antigen by immune system and in response, antibodies are produced.

70 d) Colchicine is an alkaloid which can be used as mutagen which prevents spindle formation at metaphase and lead to polyploidy formation.

71 d) Mitosis is equational division for chromosomes while DNA is reduced to half (reductional for DNA).

72 c) When single initial cell produce sporogenous cells, it is called leptosporangiate sporogenesis. It is advance character and found in Dryopteris and other advance members.

73 d) Down syndrome and Patau syndromes are trisomy (2n+1) mutation of autosomes and Klinfelter syndrome (44A+XXY) is trisomy of sex chromosome. Sickle cell anaemia is gene mutation of autosomes.

74 d) Transition area between two ecological systems or communities is ecotone. It has vegetation both ecosystems.

75 c) Oxidative phosphorylation or ETS is responsible for production of maximum ATP molecules (32 out of 36ATP) from single glucose molecules through aerobic respiration.

Zoology

76. a) Egg secretes a chemical named fertilizing (composed of glycoprotein). Sperm has on its surface a protein substances called antifertilizing (composed of amino acids).

77. b) Ecdysone - moulting hormone secreted from prothoracic glands of cockroach.

78. c) In rabbit, the lower jaw is suspended from the upper jaw by squamosal.

79. d) If muscles fibres are repeatedly stimulated to contract, these fibres take longer time to respond to the excitation during contraction and also to complete relaxation. Their force of contraction also declines progressively finally fail to contract at all for some time. It is known as muscle fatigue. It is caused by the accumulation of lactic acid.

80. b) Near each kidney there is a cylindrical testis being suspended by mesorchium.

81. d) Jacobson's organ (vomeronasal organ) in the roof of buccal cavity concerned with smell, well developed in snakes and lizards.

82. d) **Class:** Holothuroiden eg: Sea-cucumber - mouth anterior surrounded by feeding tentacles, anus at posterior end. Usually with respiratory tree for respiration.

83. b) Catadromous eg; Eel (*Anguila*)

84. a) The larva of first stage is not infective. It rests for a week and complete first moult within eggs and becomes second stage rhabditiform larva which is infective.

85. a) Dracunculus:
- Primary host → man
- Secondary/intermediate → water fieas

86. c) Cerebral ganglia - 1 pair, cerebral nerves - 8 - 10 pair

87. a)

88. a) Cro-Magnon, most recent ancestor of today's man.

89. a) When stimuli is applied, sodium potassium pump stop operating. Sodium ions rush inside and potassium ions rush outside. This results in the positive charge inside and negative charge outside. The nerve fibre is said to be in action potential, it is depolarized.

90. b) Membranous labyrinth contains a fluid called endolymph.
- Ampulla has a group of sensory hair cells called crista.
- Cristae are covered by a mass of gelatinous material called the capula.
- Cristae has longer sensory hairs and lacks otolith (also called otoconia), particles of $CaCO_3$.

91. a) **Adenohypophysis** - (i) Pars distalis, (ii) Pars tubularis, (iii) Pars intermedia

Neuro hypophysis - (i) Pars nervosa, (ii) Median eminance, (iii) Infundibular stalk

92. d) Humerus proximally bears a large head, greater tuberosity and lesser tuberosity. Between two tuberosities is a bicipital groove.

93. c) Two auricles open into a single ventricle by a common large auriclo-ventricular aperture guarded by two pairs of auriculo-ventricular valves, one arising from the dorsal edge and the other from the ventral edge of this aperture

94. a) Sodium reabsorption in DCT is controlled by primarily by aldosterone. Increase in plasma aldosterone concentration increase Na^+ reabsorption.

95. c) Dermis of thick skinned mammal is used for making leather by a process called tunning.

96. c) Gastrulation is the process of the embryonic development during which cell movements establish the three primary germinal layers namely ectoderm, mesoderm and endoderm.

97. a) According to immunity theory (pacemaker theory) there is a progressive breakdown in the immunological system with increasing age.

98. a)

Class : Pelecypoda	Eg : Scallop, sea-mussel
Class : Gastropoda	Eg: Sea lemon, sea hare
Class : Cephalopoda	Eg: *Sepia*

99. b) **Epidermis:** Stratum corneum, Stratum germinativum

Dermis: Stratum spongiosum, Straum compactum

100. a) Benign tumours is a neoplasm that does not invade other tissue or metastasize in other sites. It is usually well encapsulated in connective tissue.

Result will be published on Sunday

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Best of Luck