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IOM

Model Entrance Exam

2075

Day Shift

(Set-XIII B)

Date: 2075/04/26

Hints and Solutions

Physics

1. d) $x = a + bt + ct^2$

   velocity $v = \frac{dx}{dt} = b + c.\ 2t$

   acceleration $(a) = \frac{dv}{dt} = 2c$

2. b) $\because P = \sqrt{2mE} \Rightarrow P \propto \sqrt{m}$, for same KE (E)

   $\therefore \frac{P_1}{P_2} = \sqrt{\frac{m_1}{m_2}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$

3. a) g is maximum at poles and minimum at equator so W = mg is minimum at equator.

4. b) $E = T.\ 4\pi r^2 \Rightarrow E \propto r^2$

5. c) For adiabatic process $P_1V_1^{\gamma} = P_2V_2^{\gamma} \Rightarrow P_2 = P_1\left(\frac{V_1}{V_2}\right)^{\gamma} = \left(\frac{V}{\frac{V}{4}}\right)^{1.5}$

   $= (2^2)^{1.5} = 2^3 = 8$

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

   Here $T = 727 + 273 = 1000$ K

   $\therefore E \propto (1000)^4$

7. a) Let m gm of ice will melt

   $m\ L_f = m_w\ S_w\ \Delta\theta$

   $m \times 80 = 80 \times 1 \times (30 - 0) \Rightarrow m = 30$ g

8. a) For lens, $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$ and $\mu = A + \frac{B}{\lambda^2}$

   For red, λ is maximum so μ is minimum and hence f is maximum.

9. a) $\mu = \frac{\sin\left(\frac{A + D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$

   $\text{or } \sqrt{2} = \frac{\sin\left(\frac{60 + D_m}{2}\right)}{\sin\left(\frac{60^o}{2}\right)} = \frac{\sin\left(\frac{60^o + D_m}{2}\right)}{\frac{1}{2}}$

   $\text{or, } \frac{1}{\sqrt{2}} = \sin\left(\frac{60^o + D_m}{2}\right)$

or, $\sin 45^o = \sin\left(\frac{60^o + D_m}{2}\right) \therefore D_m = 30^o$

10. b) $\because \beta = \frac{\lambda D}{d}$ when d increases, β decreases.

11. b) Potential at centre = potential at surface = 80V

12. b) In parallel, potential difference (v) remains same

$\because q = cv \Rightarrow q \propto c$

$\therefore \frac{q_1}{q_2} = \frac{c_1}{c_2} = \frac{2}{3}$

13. b)

14. d) Inside a solenoid, the magnetic field is along the axis so in this case charged particle moves along the direction of magnetic force, so experience no force.

15. a) $E = I^2 Rt \Rightarrow I = \sqrt{\frac{E}{Rt}}$

16. c) Comparing with $y = a\cos(wt - kx)$

$k = \pi$

or $\frac{2\pi}{\lambda} = \pi \Rightarrow \lambda = 2$ cm

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

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

$= \left(\frac{330}{330 - 110}\right) \times 150$

$= \frac{330}{220} \times 150 = 225$ Hz

18. c) $\because mvR = \frac{nh}{2\pi}$

or $mv = \frac{nh}{2\pi R}$

or $2\pi R = \frac{nh}{mv} = n\frac{h}{p} = n\lambda$

19. a) $E_2 - E_1$ has maximum value and for absorption, lower to higher transition is needed.

20. d) $T_{1/2} = 5$ yrs

t = 15 yrs

$n = \frac{t}{T_{1/2}} = 3$

Remain number (N) $= \frac{N_0}{2^n} = \frac{N_0}{2^3} = \frac{N_0}{8}$

$\therefore$ fraction decayed $= 1 - \frac{1}{8} = \frac{7}{8}$

Chemistry

21. d) 1 mole of O_2 has 32g; the highest value in all the given data.

22. c) Meq. Of carbonate = Meq of acid;

$\therefore \frac{0.84}{E} \times 1000 = 40 \times \frac{1}{2}$

$\therefore E = 42$

23. b) Oxygen in H_2O_2 and $BaSO_4$ (formed) has -1 and -2 ox. No. respectively.

24. c) Alkali metals, alkaline earth metals and Al cannot be obtained during electrolysis of their aqueous salt solutions because of their strong electropositive nature.

25. d) rate $= K[A]^1$

$K = \frac{2.0 \times 10^{-5}}{0.01} = 2 \times 10^{-3}\ s^{-1}$

$\therefore t_{1/2} = \frac{0.693}{K} = \frac{0.693}{2 \times 10^{-2}} = 347s$

26. a) It is based on wetting properties of ore particles.

27. d) Nascent hydrogen is the hydrogen at the time of its generation.

28. d) From castner-kellner cell, NaOH is prepared.

29. c) $CaH_2 + 2H_2O \rightarrow Ca(OH)_2 + 2H_2$.

30. c) Wrought iron is the purest form of carbon.

32. a) Rhombic sulphur is the most stable allotrope of sulphur.

32. d) $K_c = \frac{[CO_2]}{[CO]} \therefore 5 = \frac{[CO_2]}{2.5 \times 10^{-2}} \Rightarrow [CO_2] = 0.125M$

33. a) Phenolphthalein is good indicator in the pH range 8 – 9.8

34. c) Meq. Of HCl $= 40 \times 0.1 = 4$

Meq. Of NaOH $= 10 \times 0.45 = 4.5$

$\therefore$ Meq of NaOH left = 0.5

$\therefore [OH^-] = \frac{0.5}{50} = 10^{-2} \Rightarrow$ pOH = 2 & pH = 12

35. c) $\Delta S = \frac{\Delta H_v}{T} = \frac{900 \times 18}{373} = 43.4\ J/mol$

36. a) Mole fraction of CO $= \frac{w/28}{\frac{w}{30} + \frac{w}{28}}$

37. c) Filling up of electrons in an atom obey Aufbau principle.

38. b) In 3p-subshell max. no. of electrons = 6

39. b) Bond angles of BeF_2, H_2O, NH_3 and CH_4 are 180°, 104°31', 106°51', 109°28' respectively.

40. d) H is not attached to oxygen atom.

41. a) Like atoms results in covalent bonding leading to the formation of non-polar bond, eg; H – H or H_2.

42. b) It is Electrophilic addition reaction.

43. c) In Beilsteins test, halogens burn with green edge flame on Cu wire.

44. b) a mixture of 50 – 50% of d an *l* form is called racemic mixture.

45. d) Draw all possible structures.

46. a) $C_2H_5 - \underset{\displaystyle C_2H_5}{\overset{\displaystyle 2}{CH}} - \overset{\displaystyle 1}{CH_2OH} \Rightarrow$ 2-ethylbutanol-1

47. c) C_2H_2 is not obtained during the reaction.

48. c) $C_2H_5NH_2 \xrightarrow{HNO_2} C_2H_5OH \xrightarrow{PCl_5} C_2H_5Cl \xrightarrow{NH_3} C_2H_5NH_2$

49. d) In Proteins peptide bond is present.

50. b) Starch $\xrightarrow{Diastase}$ Maltose $\xrightarrow{Maltase}$ Glucose $\xrightarrow{Zymase}$ Alcohol.

Botany

51 c) The duration between entry into host cell and exit from cell is eclipse period or window period which is non-detectable stage of viral infections.

52 a) Seaweeds or several members of brown algae are important source of Iodine, Bromine, Sulphur and Algin. Iodine can be used to treat goitre or deficiency of iodine.

53 b) Antherozoids or male gametes of Bryophytes like Funaria and Marchantia have two equal flagella.

54 a) Selaginella shows heterospory and spores are produced on sporangia present on ventral part of leaves.

55 c) First successful complete land plant with seed habit belongs to Gymnosperms.

56 d) Woody climbers are called lianas and they are found in dense tropical forests.

57 b) Cypsela is common fruit found in members of family Asteraceae. It is produced from bicarpellary with inferior or semi-inferior ovary.

58 a) Soya milk is replacement of milk and produced from cotyledons of soybean (Glycenemax).

59 c) Lignification is common character of sclerenchyma tissues and xylem elements.

60 c) High concentration of CO_2, Vaseline, intense light, PMA, ABA, etc. are considered antitranspirants which close stomata.

61 a) The ultimate and immediate source of energy in cell is ATP.

62 b) Middle lamella is outermost layer of cell wall which consists of pectin compound of calcium and magnesium. Inside middle lamella, other layers like primary cell wall, secondary cell wall and tertiary cell wall are present.

63 d) Meiosis is reductional cell division which completes in two steps. The first step is reduction division (of chromosomes) while second phase is equational (chromosome number remains constant).

64 c) Template DNA is single stranded which is produced during replication of DNA and formation of RNA.

65 b) Ophrys and Orchids show mimicry type of pollination in which insects considers orchid as its female partner.

66 d) Tissue culture technique was experimentally proved by Steward et al. in carrot root explant and theoretically proposed by Haberlandt.

67 c) The main function of tapetum is providing nutrients. It also helps in secretion of hormone, enzymes, lipids, etc.

68 a) Eutrophic lakes have high amount of organic compound due to decomposition. The oligotrophic soil contain less amount of nutrients.

69 c) Genetically monozygotic twins are similar. They may differ from each other due to environmental influences.

70 b) Heterosis is the process of formation of stronger progenies due to involvement of two different gene pools during hybridization.

71 a) Only single ATP molecule through (GTP) is produced from mitochondria through substrate level phosphorylation. The process of formation of

ATP without involvement of cytochromes is called substrate level phosphorylation. It occurs in cytosol and matrix of mitochondria.

72 b) Homospory is the primitive character of Dryopteris although it is one of the well developed fern.

73 a) Hormone of fruit ripening is ethylene which also breaks the dormancy of seed and lead to germination.

74 d) Common storage materials is carbohydrate (starch, glycogen) in cell, so storage materials usually remains in polysaccharide forms.

75 a) White clover, lentil, Sesbania, Trifolium, Crotolaria are common green manure while soybean is well known bio-fertilizer.

Zoology

76. b) Spermeogenesis -metamorphosis of sperm

Cryptorchidism- is non descent of testes in scrotum, person become sterile.

77. b) Choanocyte/collar cells found in porifera.

78. a) Because crocodile is a reptile (amniote)

79. b) Thryoxine is iodised hormone.

80. b) Eustachian tube, named after the Italian anatomist Bartolomero Eustachio, is a tube lined with mucous membrane. It joins the nasopharynx and tympanic cavity.

81. b) Corpus striatum is found in the floor of cerebrum.

82. b) Ookinet → occurs in sexual cycle

83. d) Synovial fluid is a transparent viscous fluid resembling the white of an egg. It is secreted by synovial membranes and acts as a lubricant for many joints, bursae and tendons.

84. b) Coccyx of the man is formed by the fusion of four caudal vertebrae.

85. c) Malpighian tubule: cockroach

86. b)

87. c) Stomach leads through a constricted pyloric orifice or pylorus into the intestine.

88. b) Spinal accessory-only in rabbit

Renal portal system- in frog

Diaphragm-only in rabbit

89. d) *Euspongia*-bath sponge belongs class Euspongia

90. c) Latitudinal-migration from north to south and vice versa

Eg: Siberian birds and American golden plover

91. a)

92. d)

93. d) Postganglionic sympathetic fibres are adrenic

Postganglionic parasympathetic firbes are cholinergic.

94. b) Nematocyst secrete a poison called hypriotoxin

95. c) In lungs, larva complete its second and third moulting (becomes third and fourth stage larva).

96. d)

97. d) Optocoel are paired cavities found in the optic lobes of frog. These open into iter, the canal in mid-brain.

98. c) Pectorsal/flight muscles of birds are attached to keel, sternum of birds.

99. a) Osphradium-water tasting organ.

100. a) Thymus consists of peripheral cortex and central medulla. The medulla contains characteristic thymic (Hassall's corpuscles)

Result will be published on Sunday

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Best of Luck