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<b>PAPER – I CHEMISTRY &amp; PHYSICS</b>			
<b>Version Code</b>	<b>A3</b>	<b>Question Booklet Serial Number :</b>	
<b>Time : 150 Minutes</b>	<b>Number of Questions : 120</b>	<b>Maximum Marks : 480</b>	
<b>Name of Candidate</b>			
<b>Roll Number</b>			
<b>Signature of Candidate</b>			
<b>INSTRUCTIONS TO THE CANDIDATE</b>			
<p>1. Please ensure that the <b>VERSION CODE</b> shown at the top of this Question Booklet is the same as that shown in the OMR Answer Sheet issued to you. If you have received a Question Booklet with a different Version Code, please get it replaced with a Question Booklet with the same Version Code as that of the OMR Answer Sheet from the Invigilator. <b>THIS IS VERY IMPORTANT.</b></p> <p>2. Please fill in the items such as Name, Roll Number and Signature in the columns given above. Please also write Question Booklet Sl. No. given at the top of this page against item 4 in the OMR Answer Sheet.</p> <p>3. This Question Booklet contains 120 questions. For each question, five answers are suggested and given against (A), (B), (C), (D) and (E) of which only one will be the <b>Most Appropriate Answer</b>. Mark the bubble containing the letter corresponding to the 'Most Appropriate Answer' in the OMR Answer Sheet, by using either <b>Blue or Black ball - point pen only.</b></p> <p>4. <b>Negative Marking:</b> In order to discourage wild guessing, the score will be subjected to penalization formula based on the number of right answers actually marked and the number of wrong answers marked. Each correct answer will be awarded <b>FOUR</b> marks. <b>ONE</b> mark will be deducted for each incorrect answer. More than one answer marked against a question will be deemed as incorrect answer and will be negatively marked.</p> <p>5. Please read the instructions given in the OMR Answer Sheet for marking answers. Candidates are advised to strictly follow the instructions contained in the OMR Answer Sheet.</p>			
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# Mathrubhumi Education

Chem-Phy-I-11-A3

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**PLEASE ENSURE THAT THIS QUESTION BOOKLET CONTAINS 120  
QUESTIONS SERIALLY NUMBERED FROM 1 TO 120.  
PRINTED PAGES : 32**

1. A current is passed through two cells connected in series. The first cell contains  $X(\text{NO}_3)_3(\text{aq})$  and the second cell contains  $Y(\text{NO}_3)_2(\text{aq})$ . The relative atomic masses of X and Y are in the ratio 1:2. What is the ratio of liberated mass of X to that of Y?  
(A) 3 : 2                                      (B) 1 : 2                                      (C) 1 : 3  
(D) 3 : 1                                      (E) 2 : 1
2. For a first order reaction, the time taken to reduce the initial concentration by a factor of 1/4 is 20 minutes. The time required to reduce initial concentration by a factor of 1/16 is  
(A) 20 min                                      (B) 10 min                                      (C) 80 min  
(D) 40 min                                      (E) 5 min
3. Which one of the following is correctly matched?  
(A) emulsion – smoke                      (B) gel – butter                              (C) aerosol – hair cream  
(D) sol – whipped cream                  (E) foam – mist
4. Which one of the following has the highest molar conductivity?  
(A) Diamminedichloroplatinum(II)  
(B) Tetraamminedichlorocobalt(III) chloride  
(C) Potassium hexacyanoferrate(II)  
(D) Hexaaquochromium(III) chloride  
(E) Potassium hexacyanoferrate(III)
5. The ligand  $\text{N}(\text{CH}_2\text{CH}_2\text{NH}_2)_3$  is  
(A) tridentate                                      (B) pentadentate                              (C) tetradentate  
(D) bidentate                                      (E) hexadentate

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Space for rough work

6. The enthalpy of solution of sodium chloride is  $4 \text{ kJ mol}^{-1}$  and its enthalpy of hydration of ions is  $-784 \text{ kJ mol}^{-1}$ . Then the lattice enthalpy of NaCl (in  $\text{kJ mol}^{-1}$ ) is  
 (A) + 788 (B) + 4 (C) + 398  
 (D) + 780 (E) + 394
7. In the reaction  $\text{AB(g)} \rightleftharpoons \text{A(g)} + \text{B(g)}$  at  $30^\circ\text{C}$ ,  $K_p$  for the dissociation equilibrium is  $2.56 \times 10^{-2}$  atm. If the total pressure at equilibrium is 1 atm, then the percentage dissociation of AB is  
 (A) 87 % (B) 13 % (C) 43.5 %  
 (D) 6 % (E) 16 %
8. At  $25^\circ\text{C}$ , the solubility product of  $\text{Hg}_2\text{Cl}_2$  in water is  $3.2 \times 10^{-17} \text{ mol}^3 \text{dm}^{-9}$ . What is the solubility of  $\text{Hg}_2\text{Cl}_2$  in water at  $25^\circ\text{C}$ ?  
 (A)  $1.2 \times 10^{-12} \text{ M}$  (B)  $3.0 \times 10^{-6} \text{ M}$  (C)  $2 \times 10^{-6} \text{ M}$   
 (D)  $1.2 \times 10^{-16} \text{ M}$  (E)  $5.2 \times 10^{-6} \text{ M}$
9. Match the following correctly
- | Catalyst                   | Industrial Product            |                            |
|----------------------------|-------------------------------|----------------------------|
| (a) $\text{V}_2\text{O}_5$ | (i) High Density Polyethylene |                            |
| (b) Ziegler-Natta          | (ii) Polyacrylonitrile        |                            |
| (c) Peroxide               | (iii) $\text{NH}_3$           |                            |
| (d) Finely divided Fe      | (iv) $\text{H}_2\text{SO}_4$  |                            |
| (A) a-iv, b-i, c-ii, d-iii | (B) a-iv, b-iii, c-ii, d-i    | (C) a-iii, b-i, c-ii, d-iv |
| (D) a-iv, b-ii, c-i, d-iii | (E) a-iv, b-i, c-iii, d-ii    |                            |

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Space for rough work

10. A monobasic weak acid solution has a molarity of 0.005 and pH of 5. What is its percentage ionization in this solution?  
(A) 2.0 (B) 0.2 (C) 0.5  
(D) 0.25 (E) 20.0
11. Choose the incorrect statement in respect of physisorption  
(A) It is not specific in nature.  
(B) It arises because of van der Waals' forces.  
(C) It is reversible in nature.  
(D) No appreciable activation energy is needed.  
(E) Enthalpy of adsorption is in the range  $80 - 240 \text{ kJ mol}^{-1}$ .
12. Four grams of graphite is burnt in a bomb calorimeter of heat capacity  $30 \text{ kJ K}^{-1}$  in excess of oxygen at 1 atmospheric pressure. The temperature rises from 300 to 304 K. What is the enthalpy of combustion of graphite (in  $\text{kJ mol}^{-1}$ )?  
(A) 360 (B) 1440 (C) - 360  
(D) - 1440 (E) - 520
13. In hexa-1,3-diene-5-yne the number of C-C  $\sigma$ , C-C  $\pi$  and C-H  $\sigma$  bonds respectively are  
(A) 5, 4 and 6 (B) 6, 3 and 5 (C) 5, 3 and 6  
(D) 6, 4 and 5 (E) 5, 5 and 5
14. The number of primary, secondary, tertiary and quaternary carbons in neopentane are respectively  
(A) 4, 3, 2 and 1 (B) 5, 0, 0 and 1 (C) 4, 0, 0 and 1  
(D) 4, 0, 1 and 1 (E) 4, 1, 0 and 0

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Space for rough work

15. Which one of the following is a non-benzenoid aromatic compound?  
(A) aniline (B) benzoic acid (C) naphthalene  
(D) tropolone (E) anthracene
16. A hydrocarbon contains 80% carbon. What is the empirical formula of the compound?  
(A) CH<sub>2</sub> (B) CH<sub>3</sub> (C) CH<sub>4</sub>  
(D) CH (E) C<sub>2</sub>H<sub>3</sub>
17. When one mole of an alkene on ozonolysis produces 2 moles of propanone, the alkene is  
(A) 3-methyl-1-butene  
(B) 2,3-dimethyl-1-butene  
(C) 2, 3-dimethyl-2-pentene  
(D) Isobutene  
(E) 2, 3-dimethyl-2-butene
18. Which one of the following has the lowest boiling point?  
(A) 2-methylbutane (B) 2-methylpropane (C) 2, 2-dimethylpropane  
(D) *n*-pentane (E) *n*-butane
19. Which one of the following exhibits geometrical isomerism?  
(A) 1, 2-dibromopropene  
(B) 2, 3-dimethylbut-2-ene  
(C) 2, 3-dibromobut-2-ene  
(D) 2-methylbut-2-ene  
(E) 2, 3-dibromobut-1-ene

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Space for rough work

20. Reaction of hydrogen bromide with propene in the absence of peroxide is a/an  
(A) free radical addition (B) nucleophilic addition (C) electrophilic substitution  
(D) electrophilic addition (E) nucleophilic substitution
21. Which of the following compounds can yield only one monochlorinated product upon free radical chlorination?  
(A) propane (B) 2,2-dimethylpropane (C) 2-methylpropane  
(D) *n*-butane (E) 2-methylbutane
22. Chlorobenzene on treatment with sodium in dry ether gives diphenyl. The name of the reaction is  
(A) Fittig reaction  
(B) Wurtz-Fittig reaction  
(C) Sandmeyer reaction  
(D) Gatterman reaction  
(E) Wurtz reaction
23. Among the following, the optically active compound is  
(A)  $\text{CH}_3\text{CH}_2\text{OH}$  (B)  $\text{CH}_3\text{CH}=\text{CHCH}_3$  (C)  $\text{CH}_3\text{CHDOH}$   
(D)  $\text{CH}_3\text{CH}_2\text{COCH}_3$  (E)  $\text{CH}_3\text{CHO}$

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Space for rough work

24. The compounds  $\text{CH}_3\text{CH}=\text{CHCH}_3$  and  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- (A) are tautomers
  - (B) are position isomers
  - (C) contain same number of  $\text{sp}^3\text{-sp}^3$ ,  $\text{sp}^3\text{-sp}^2$  and  $\text{sp}^2\text{-sp}^2$  carbon-carbon bonds
  - (D) exist together in dynamic equilibrium
  - (E) are optical isomers
25. In alkaline hydrolysis of a tertiary alkyl halide by aqueous alkali, if concentration of alkali is doubled, then the reaction rate at constant temperature
- (A) will be doubled
  - (B) will be halved
  - (C) will become four times greater
  - (D) will be tripled
  - (E) will remain constant
26. An alkyl halide with molecular formula  $\text{C}_6\text{H}_{13}\text{Br}$  on dehydrohalogenation gave two isomeric alkenes X and Y with molecular formula  $\text{C}_6\text{H}_{12}$ . On reductive ozonolysis, X and Y gave four compounds  $\text{CH}_3\text{COCH}_3$ ,  $\text{CH}_3\text{CHO}$ ,  $\text{CH}_3\text{CH}_2\text{CHO}$  and  $(\text{CH}_3)_2\text{CHCHO}$ . The alkyl halide is
- (A) 2-bromohexane
  - (B) 2, 2-dimethyl-1-bromobutane
  - (C) 4-bromo-2-methylpentane
  - (D) 2-bromo-2, 3-dimethylbutane
  - (E) 3-bromo-2-methylpentane
27. The compound that does not undergo hydrolysis by  $\text{S}_{\text{N}}1$  mechanism is
- (A)  $\text{CH}_2=\text{CHCH}_2\text{Cl}$
  - (B)  $\text{C}_6\text{H}_5\text{Cl}$
  - (C)  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$
  - (D)  $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Cl}$
  - (E)  $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Cl}$
28. Which one of the following has antiseptic property?
- (A) dichloromethane
  - (B) trifluoromethane
  - (C) triiodomethane
  - (D) tetrachloromethane
  - (E) Freon-12

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Space for rough work



29. The compound that neither forms semicarbazone nor oxime is  
(A) HCHO (B)  $\text{CH}_3\text{COCH}_2\text{Cl}$  (C)  $\text{CH}_3\text{CHO}$   
(D)  $\text{CH}_3\text{CONHCH}_3$  (E)  $(\text{CH}_3)_2\text{CHCHO}$
30. The compound that undergoes dehydration very easily is  
(A) 2-methyl-propan-2-ol (B) ethyl alcohol (C) 3-methyl-2-butanol  
(D) propyl alcohol (E) methanol
31. Which of the following alcohols gives the best yield of dialkyl ether on being heated with a trace of sulphuric acid?  
(A) 2-pentanol (B) cyclopentanol (C) 2-methyl-2-butanol  
(D) 2-propanol (E) 1-pentanol
32. Which of the following pairs can be distinguished by sodium hypoiodite?  
(A)  $\text{CH}_3\text{CHO}$  and  $\text{CH}_3\text{COCH}_3$   
(B)  $\text{CH}_3\text{CH}_2\text{CHO}$  and  $\text{CH}_3\text{COCH}_3$   
(C)  $\text{CH}_3\text{CH}_2\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{CHOHCH}_3$   
(D)  $\text{CH}_3\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{CHO}$   
(E)  $\text{CH}_3\text{OH}$  and  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
33. Anilinium hydrogensulphate on heating with sulphuric acid at 453-473 K produces  
(A) benzene sulphonic acid  
(B) anthranilic acid  
(C) aniline  
(D) *m*-aminobenzene sulphonic acid  
(E) sulphanilic acid

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Space for rough work

34. The strongest base in aqueous solution among the following amines is  
(A) N, N-Diethylethanamine (B) N-Ethylethanamine (C) N-Methylmethanamine  
(D) Ethanamine (E) Phenylmethanamine
35. Aniline is treated with bromine water to give an organic compound 'X' which when treated with  $\text{NaNO}_2$  and  $\text{HCl}$  at  $0^\circ\text{C}$  gives a water soluble compound 'Y'. Compound 'Y' on treatment with  $\text{Cu}_2\text{Cl}_2$  and  $\text{HCl}$  gives compound 'Z'. Compound 'Z' is  
(A) *o*-Bromochlorobenzene  
(B) *p*-Bromochlorobenzene  
(C) 2,4,6-Tribromophenol  
(D) 2,4,6-Tribromochlorobenzene  
(E) 2,4-Dibromophenol
36. The linkage between the two monosaccharide units in lactose is  
(A) C1 of  $\beta$ -D-glucose and C4 of  $\beta$ -D-galactose  
(B) C1 of  $\beta$ -D-galactose and C4 of  $\beta$ -D-glucose  
(C) C1 of  $\alpha$ -D-galactose and C4 of  $\beta$ -D-glucose  
(D) C1 of  $\beta$ -D-galactose and C4 of  $\alpha$ -D-glucose  
(E) C1 of  $\alpha$ -D-glucose and C4 of  $\alpha$ -D-glucose
37. Glucose does not react with  
(A)  $\text{Br}_2/\text{H}_2\text{O}$  (B)  $\text{H}_2\text{N}-\text{OH}$  (C)  $\text{HI}$   
(D)  $\text{NaHSO}_3$  (E)  $\text{CH}_3-\text{CO}-\text{O}-\text{CO}-\text{CH}_3$
38. The vitamin that is not soluble in water is  
(A) Vitamin B<sub>1</sub> (B) Vitamin B<sub>2</sub> (C) Vitamin B<sub>6</sub>  
(D) Vitamin C (E) Vitamin D
39. Excess nitrate in drinking water can cause  
(A) methemoglobinemia (B) kidney damage (C) liver damage  
(D) laxative effect (E) leucoderma
40. Terfenadine is commonly used as a/an  
(A) Tranquilizer (B) Antihistamine (C) Antimicrobial  
(D) Antibiotic (E) Antifertility drug

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Space for rough work

41. For Balmer series in the spectrum of atomic hydrogen, the wave number of each line is given by  $\bar{\nu} = R_H \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$  where  $R_H$  is a constant and  $n_1$  and  $n_2$  are integers. Which of the following statement(s) is (are) correct?
1. As wavelength decreases, the lines in the series converge
  2. The integer  $n_1$  is equal to 2
  3. The ionisation energy of hydrogen can be calculated from the wave number of these lines
  4. The line of longest wavelength corresponds to  $n_2 = 3$
- (A) 1, 2 and 3                      (B) 2, 3 and 4                      (C) 1, 2 and 4  
 (D) 2 and 4 only                      (E) 2 only
42. Which one of the following sets of compounds correctly illustrate the law of reciprocal proportions?
- (A)  $P_2O_3$ ,  $PH_3$ ,  $H_2O$                       (B)  $P_2O_5$ ,  $PH_3$ ,  $H_2O$                       (C)  $N_2O_5$ ,  $NH_3$ ,  $H_2O$   
 (D)  $N_2O$ ,  $NH_3$ ,  $H_2O$                       (E)  $NO_2$ ,  $NH_3$ ,  $H_2O$
43. In which one of the following pairs the two species are both isoelectronic and isotopic? (Atomic numbers: Ca=20, Ar=18, K=19, Mg=12, Fe=26, Na=11)
- (A)  $^{40}Ca^{2+}$  and  $^{40}Ar$                       (B)  $^{39}K^+$  and  $^{40}K^-$                       (C)  $^{24}Mg^{2+}$  and  $^{25}Mg$   
 (D)  $^{23}Na$  and  $^{24}Na^+$                       (E)  $^{56}Fe^{3+}$  and  $^{57}Fe^{2+}$
44. 20.0 kg of  $N_2(g)$  and 3.0 kg of  $H_2(g)$  are mixed to produce  $NH_3(g)$ . The amount of  $NH_3(g)$  formed is
- (A) 17 kg                      (B) 34 kg                      (C) 20 kg  
 (D) 3 kg                      (E) 23 kg

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Space for rough work

45. The covalent bond length is the shortest in which one of the following bonds?  
(A) C-O (B) C-C (C) C=N  
(D) O-H (E) C≡C
46. Among the following molecules: SO<sub>2</sub>, SF<sub>4</sub>, ClF<sub>3</sub>, BrF<sub>5</sub> and XeF<sub>4</sub>, which of the following shapes does not describe any of the molecules mentioned?  
(A) Bent (B) Trigonal bipyramidal (C) See-saw  
(D) T-shape (E) Square pyramidal
47. A bubble of gas released at the bottom of a lake increases to eight times its original volume when it reaches the surface. Assuming that atmospheric pressure is equivalent to the pressure exerted by a column of water 10 m height, the depth of the lake is  
(A) 80 m (B) 90 m (C) 40 m  
(D) 10 m (E) 70 m
48. Three different gases X, Y and Z of molecular masses 2, 16 and 64 were enclosed in a vessel at constant temperature till equilibrium is reached. Which of the following statement is correct?  
(A) Gas Z will be at the top of the vessel  
(B) Gas Y will be at the top of the vessel  
(C) Gas Z will be at the bottom and X will be at the top  
(D) Gas X will be at the bottom and Z will be at the top  
(E) Gases will form homogeneous mixture
49. Which of the following is a correct statement?  
(A) Surface tension of a liquid decreases with increase in temperature  
(B) Vapour pressure of a liquid decreases with increase in temperature  
(C) Viscosity of a liquid decreases with decrease in temperature  
(D) The boiling point of a liquid is independent of the altitude of the place  
(E) In gravity free environments, droplets of a liquid on flat surface are slightly flattened

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Space for rough work

50. The bond enthalpy is the highest for  
(A)  $F_2$  (B)  $Cl_2$  (C)  $Br_2$   
(D)  $I_2$  (E)  $H_2$
51. The correct order of decreasing electronegativity values among the elements I - beryllium, II - oxygen, III - nitrogen and IV - magnesium, is  
(A) (II) > (III) > (I) > (IV)  
(B) (III) > (IV) > (II) > (I)  
(C) (I) > (II) > (III) > (IV)  
(D) (I) > (II) > (IV) > (III)  
(E) (II) > (III) > (IV) > (I)
52. Permanent hardness of water is due to the presence of  
(A) bicarbonates of sodium and potassium  
(B) chlorides and sulphates of sodium and potassium  
(C) chlorides and sulphates of calcium and magnesium  
(D) bicarbonates of calcium and magnesium  
(E) phosphates of sodium and potassium
53. Which one of the following does not occur as sulphide ore?  
(A) Zn (B) Cr (C) Ag  
(D) Fe (E) Hg
54. The increasing order of the density of alkali metals is  
(A)  $Li < K < Na < Rb < Cs$   
(B)  $Li < Na < K < Rb < Cs$   
(C)  $Cs < Rb < Na < K < Li$   
(D)  $Cs < Rb < K < Na < Li$   
(E)  $Li < Na < Rb < K < Cs$

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Space for rough work

55. The alkali halide that is soluble in pyridine is  
(A) NaCl (B) LiCl (C) KCl  
(D) CsI (E) NaBr
56. When  $\text{Br}_2$  is treated with aqueous solutions of NaF, NaCl and NaI separately  
(A)  $\text{F}_2$ ,  $\text{Cl}_2$  and  $\text{I}_2$  are liberated  
(B) only  $\text{F}_2$  and  $\text{Cl}_2$  are liberated  
(C) only  $\text{I}_2$  is liberated  
(D) only  $\text{Cl}_2$  is liberated  
(E) only  $\text{Cl}_2$  and  $\text{I}_2$  are liberated
57. The basicity of pyrophosphorous acid is  
(A) 2 (B) 4 (C) 1  
(D) 5 (E) 3
58. The oxidation state of phosphorus in cyclotrimetaphosphoric acid is  
(A) + 3 (B) + 5 (C) - 3  
(D) + 2 (E) - 2
59. Which of the following species is/are paramagnetic?  
 $\text{Fe}^{2+}$ ,  $\text{Zn}^0$ ,  $\text{Hg}^{2+}$ ,  $\text{Ti}^{4+}$   
(A)  $\text{Fe}^{2+}$  only (B)  $\text{Zn}^0$  and  $\text{Ti}^{4+}$  (C)  $\text{Fe}^{2+}$  and  $\text{Hg}^{2+}$   
(D)  $\text{Zn}^0$  and  $\text{Hg}^{2+}$  (E)  $\text{Fe}^{2+}$  and  $\text{Ti}^{4+}$

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Space for rough work

60. The titanium (atomic number 22) compound that does not exist is  
(A) TiO (B) TiO<sub>2</sub> (C) K<sub>2</sub>TiF<sub>6</sub>  
(D) TiCl<sub>3</sub> (E) K<sub>2</sub>TiO<sub>4</sub>
61. The acidic, basic or amphoteric nature of Mn<sub>2</sub>O<sub>7</sub>, V<sub>2</sub>O<sub>5</sub> and CrO are respectively  
(A) acidic, acidic and basic  
(B) basic, amphoteric and acidic  
(C) acidic, amphoteric and basic  
(D) acidic, basic and amphoteric  
(E) acidic, basic and basic
62. The hydrogen bond is shortest in  
(A) S-H...S (B) N-H...O (C) S-H...O  
(D) F-H...O (E) F-H...F
63. A reaction is spontaneous at low temperature but non-spontaneous at high temperature. Which of the following is true for the reaction?  
(A)  $\Delta H > 0, \Delta S > 0$  (B)  $\Delta H < 0, \Delta S > 0$  (C)  $\Delta H > 0, \Delta S = 0$   
(D)  $\Delta H < 0, \Delta S < 0$  (E)  $\Delta H = 0, \Delta S < 0$

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Space for rough work

64. For the reaction  $C(s) + CO_2(g) \rightarrow 2CO(g)$ ,  $K_p=63$  atm at 1000 K. If at equilibrium  $P_{CO} = 10 P_{CO_2}$ , then the total pressure of the gases at equilibrium is  
(A) 6.3 atm (B) 6.93 atm (C) 0.63 atm  
(D) 0.693 atm (E) 69.3 atm
65. The system that forms maximum boiling azeotrope is  
(A) carbondisulphide - acetone  
(B) benzene - toluene  
(C) acetone - chloroform  
(D) *n*-hexane - *n*-heptane  
(E) ethanol - acetone
66. Which one of the following statements is false?  
(A) Raoult's law states that the vapour pressure of a component over a binary solution of volatile liquids is directly proportional to its mole fraction  
(B) Two sucrose solutions of the same molality prepared in different solvents will have the same depression of freezing point  
(C) The correct order of osmotic pressures of 0.01M solution of each compound is  $BaCl_2 > KCl > CH_3COOH > Glucose$   
(D) In the equation osmotic pressure  $\Pi = MRT$ , M is the molarity of the solution  
(E) The molecular weight of NaCl determined by colligative property measurement is less than its theoretical molecular weight
67. Which pair of electrolytes could not be distinguished by the products of electrolysis using inert electrodes?  
(A) 1M  $CuSO_4$  solution, 1M  $CuCl_2$  solution  
(B) 1M KCl solution, 1M KI solution  
(C) 1M  $AgNO_3$  solution, 1M  $Cu(NO_3)_2$  solution  
(D) 1M KCl solution, 1M NaCl solution  
(E) 1M  $CuBr_2$  solution, 1M  $CuSO_4$  solution

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Space for rough work



68. The initial rates of reaction  $3A + 2B + C \rightarrow \text{products}$ , at different initial concentrations are given below.

Initial Rate, $\text{Ms}^{-1}$	$[A]_0$ , M	$[B]_0$ , M	$[C]_0$ , M
$5.0 \times 10^{-3}$	0.010	0.005	0.010
$5.0 \times 10^{-3}$	0.010	0.005	0.015
$1.0 \times 10^{-2}$	0.010	0.010	0.010
$1.25 \times 10^{-3}$	0.005	0.005	0.010

The order with respect to the reactants A, B and C are respectively

- (A) 3, 2, 0 (B) 3, 2, 1 (C) 2, 2, 0  
(D) 2, 2, 1 (E) 2, 1, 0
69. The rate law for the reaction  $x\text{A} + y\text{B} \rightarrow m\text{P} + n\text{Q}$  is  $\text{Rate} = k[\text{A}]^x[\text{B}]^y$ . What is the total order of the reaction?  
(A)  $(x + y)$  (B)  $(m + n)$  (C)  $(c + d)$   
(D)  $x/y$  (E) Two
70. Ammonia will not form complex with  
(A)  $\text{Ag}^{2+}$  (B)  $\text{Pb}^{2+}$  (C)  $\text{Cu}^{2+}$   
(D)  $\text{Cd}^{2+}$  (E)  $\text{Fe}^{2+}$

71. At the sublimation temperature, for the process  $\text{CO}_2(\text{s}) \rightleftharpoons \text{CO}_2(\text{g})$

- (A)  $\Delta H$ ,  $\Delta S$  and  $\Delta G$  are all positive  
(B)  $\Delta H > 0$ ,  $\Delta S > 0$  and  $\Delta G < 0$   
(C)  $\Delta H < 0$ ,  $\Delta S > 0$  and  $\Delta G < 0$   
(D)  $\Delta H > 0$ ,  $\Delta S > 0$  and  $\Delta G > 0$   
(E)  $\Delta H > 0$ ,  $\Delta S > 0$  and  $\Delta G = 0$

72. Which one of the following gases has the lowest value of Henry's law constant?

- (A)  $\text{N}_2$  (B) He (C)  $\text{H}_2$   
(D)  $\text{CO}_2$  (E)  $\text{O}_2$

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Space for rough work

73. The total electric flux emanating from a closed surface enclosing an  $\alpha$ -particle (e-electronic charge) is
- (A)  $\frac{2e}{\epsilon_0}$       (B)  $\frac{e}{\epsilon_0}$       (C)  $e \epsilon_0$       (D)  $\frac{\epsilon_0 e}{4}$       (E)  $\frac{4e}{\epsilon_0}$
74. The work done in carrying a charge  $q$  once round a circle of radius 'a' with a charge Q at its centre is
- (A)  $\frac{qQ}{4\pi \epsilon_0 a}$       (B)  $\frac{qQ}{4\pi \epsilon_0 a^2}$       (C)  $\frac{q}{4\pi \epsilon_0 a}$       (D)  $\frac{q}{4\pi \epsilon_0 a^2}$       (E) zero
75. A parallel plate capacitor is connected to a 5 V battery and charged. The battery is then disconnected and a glass slab is introduced between the plates. Then the quantities that decrease are
- (A) charge and potential difference  
(B) charge and capacitance  
(C) capacitance and potential difference  
(D) energy stored and capacitance  
(E) energy stored and potential difference
76. Two identical conductors maintained at different temperatures are given potential differences in the ratio 1:2. Then the ratio of their drift velocities is
- (A) 1:2      (B) 3:2      (C) 1:1      (D)  $1:2^{1/2}$       (E) 1:4

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77. On increasing the temperature of a conductor, its resistance increases because the
- (A) relaxation time increases
  - (B) mass of electron increases
  - (C) electron density decreases
  - (D) relaxation time decreases
  - (E) relaxation time remains constant
78. Two batteries of emfs 2 V and 1 V of internal resistances 1  $\Omega$  and 2  $\Omega$  respectively are connected in parallel. The effective emf of the combination is
- (A)  $\frac{3}{2}$  V      (B)  $\frac{5}{3}$  V      (C)  $\frac{3}{5}$  V      (D) 2 V      (E) 5 V
79. Choose the CORRECT statement
- (A) Current sensitivity of a moving coil galvanometer is inversely proportional to the magnetic induction
  - (B) To convert a galvanometer into an ammeter, a high resistance is connected in series
  - (C) To convert a galvanometer into a voltmeter, a low resistance is connected in parallel
  - (D) Voltage sensitivity of a moving coil galvanometer is directly proportional to the magnetic induction
  - (E) The zero of an ohm meter scale is at the left most end of the scale

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80. Two particles A and B having equal charges  $+6\text{ C}$ , after being accelerated through the same potential difference, enter a region of uniform magnetic field and describe circular paths of radii  $2\text{ cm}$  and  $3\text{ cm}$  respectively. The ratio of mass of A to that of B is
- (A)  $\frac{4}{9}$       (B)  $\frac{9}{5}$       (C)  $\frac{1}{2}$       (D)  $\frac{1}{3}$       (E)  $\frac{9}{4}$
81. Ampere's circuital law can be derived from
- (A) Ohm's law  
(B) Biot-Savart law  
(C) Kirchhoff's law  
(D) Gauss' law  
(E) Coulomb's law
82. One conducting U-tube can slide into another U-tube, maintaining electrical contacts between them. A magnetic field  $B$  is acting perpendicular to the plane of slide. If each tube moves at a constant speed  $v$  towards each other, then the emf induced in the circuit is
- (A)  $\frac{3}{2} B/v$       (B)  $0$       (C)  $- B/v$       (D)  $B/v$       (E)  $2B/v$

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83. Two solenoids of equal number of turns have their lengths and the radii in the same ratio 1:2. The ratio of their self inductances will be  
(A) 1 : 2      (B) 2 : 1      (C) 1 : 1      (D) 1 : 4      (E) 1 : 3
84. Pick out the FALSE statement from the following:  
(A) The direction of eddy current is given by Fleming's right hand rule  
(B) A choke coil is a pure inductor used for controlling current in an a.c. circuit  
(C) The energy stored in a conductor of capacitance C having a charge  $q$  is  $\frac{1}{2} Cq^2$   
(D) The magnetic energy stored in a coil of self-inductance L carrying current I is  $\frac{1}{2} LI^2$   
(E) Induction coil is a powerful equipment used for generating high voltages
85. The electromagnetic wave having the shortest wavelength is  
(A) X-rays      (B)  $\gamma$ -rays      (C) infrared rays  
(D) microwaves      (E) radiowaves
86. Light travels in two media A and B with speeds  $1.8 \times 10^8 \text{ ms}^{-1}$  and  $2.4 \times 10^8 \text{ ms}^{-1}$  respectively. Then the critical angle between them is  
(A)  $\sin^{-1}\left(\frac{2}{3}\right)$       (B)  $\tan^{-1}\left(\frac{3}{4}\right)$       (C)  $\tan^{-1}\left(\frac{2}{3}\right)$       (D)  $\sin^{-1}\left(\frac{3}{4}\right)$       (E)  $\sin^{-1}\left(\frac{1}{4}\right)$

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Space for rough work

87. A ray of light is incident at  $60^\circ$  on one face of a prism of angle  $30^\circ$  and the emergent ray makes  $30^\circ$  with the incident ray. The refractive index of the prism is  
(A) 1.732      (B) 1.414      (C) 1.5      (D) 1.33      (E) 1.6
88. In Young's double slit experiment, if  $d$ ,  $D$  and  $\lambda$  represent, the distance between the slits, the distance of the screen from the slits and wavelength of light used respectively, then the band width is inversely proportional to  
(A)  $\lambda$       (B)  $d$       (C)  $D$       (D)  $\lambda^2$       (E)  $D^2$
89. If a proton and electron have the same de-Broglie wavelength, then  
(A) kinetic energy of electron < kinetic energy of proton  
(B) kinetic energy of electron = kinetic energy of proton  
(C) momentum of electron > momentum of proton  
(D) momentum of electron = momentum of proton  
(E) momentum of electron < momentum of proton
90. A uranium nucleus  ${}_{92}\text{U}^{238}$  emits an  $\alpha$ -particle and a  $\beta$ -particle in succession. The atomic number and mass number of the final nucleus will be  
(A) 90, 233      (B) 90, 238      (C) 91, 238      (D) 93, 238      (E) 91, 234
91. Heavy water is used in nuclear reactors  
(A) to absorb neutrons to sustain controlled reaction  
(B) to absorb neutrons to stop the chain reaction  
(C) to reduce hazardous radiation from nuclear reaction  
(D) to slow down the neutrons to thermal energies  
(E) to speed up the nuclear reaction as catalyst

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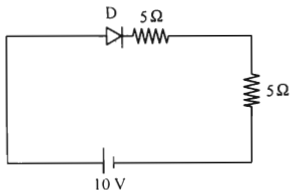
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92. A semiconductor with a band gap of 2.5 eV is used to fabricate a  $p$ - $n$  photodiode. It can detect a signal of wavelength  
 (A) 4000 nm (B) 6000 Å (C) 6000 nm (D) 4000 Å (E) 5500 Å
93. In the circuit given, A, B and C are inputs and Y is the output



The output of Y is

- (A) high for all the high inputs  
 (B) high for all the low inputs  
 (C) high when  $A = 1, B = 1, C = 0$   
 (D) low when  $A = 0, B = 0, C = 1$   
 (E) low for all low inputs
94. In the given circuit for ideal diode, the current through the battery is



- (A) 0.5 A (B) 1.5 A (C) 1.0 A (D) 2 A (E) 2.5 A

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Space for rough work

95. If the TV telecast is to cover a radius of 120 km (given the radius of the earth = 6400 km), the height of the transmitting antenna is  
(A) 1280 m      (B) 1125 m      (C) 1560 m      (D) 79 m      (E) 1050 m
96. Identify the INCORRECT statement from the following  
(A) AM detection is carried out using a rectifier and an envelop detector.  
(B) Pulse position denotes the time of rise or fall of the pulse amplitude.  
(C) Modulation index  $\mu$  is kept  $\geq 1$ , to avoid distortion.  
(D) Facsimile (FAX) scans the contents of the document to create electronic signals.  
(E) Detection is the process of recovering the modulating signal from the modulated carrier wave.
97. The mobile telephones operate typically in the range of  
(A) 1 – 100 MHz  
(B) 100 – 200 MHz  
(C) 1000 – 2000 MHz  
(D) 800 – 950 MHz  
(E) 10 – 1000 KHz

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Space for rough work



98. Surface tension has the same dimensions as that of  
(A) coefficient of viscosity  
(B) impulse  
(C) momentum  
(D) spring constant  
(E) frequency
99. A stone falls freely from rest from a height  $h$  and it travels a distance  $\frac{9h}{25}$  in the last second. The value of  $h$  is  
(A) 145 m  
(B) 100 m  
(C) 122.5 m  
(D) 200 m  
(E) 175 m
100. The area under velocity–time graph for a particle in a given interval of time represents  
(A) velocity  
(B) acceleration  
(C) work done  
(D) momentum  
(E) displacement

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Space for rough work

101. If vectors  $\hat{i} - 3\hat{j} + 5\hat{k}$  and  $\hat{i} - 3\hat{j} - a\hat{k}$  are equal vectors, then the value of  $a$  is  
(A) 5                      (B) 2                      (C) -3                      (D) 4                      (E) -5
102. Two forces in the ratio 1:2 act simultaneously on a particle. The resultant of these forces is three times the first force. The angle between them is  
(A)  $0^\circ$                       (B)  $60^\circ$                       (C)  $90^\circ$                       (D)  $45^\circ$                       (E)  $30^\circ$
103. A fighter aircraft is looping in a vertical plane. The minimum velocity at the highest point is (given  $r$  = radius of the loop)  
(A)  $\sqrt{\frac{1}{2}gr}$                       (B)  $\sqrt{2gr}$                       (C)  $\sqrt{gr}$                       (D)  $\sqrt{3gr}$                       (E)  $\sqrt{4gr}$
104. Two bodies of masses 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a frictionless pulley. The acceleration of the system is  
(A)  $\frac{g}{2}$                       (B)  $\frac{g}{3}$                       (C)  $\frac{g}{5}$                       (D)  $\frac{g}{10}$                       (E)  $\frac{g}{4}$

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Space for rough work

105. Choose the INCORRECT statement:

- (A) No work is done if the displacement is perpendicular to the direction of the applied force
- (B) If the angle between the force and displacement vectors is obtuse, then the work done is negative
- (C) Frictional force is non-conservative
- (D) All the central forces are non-conservative
- (E) Kinetic energy is conserved in elastic collision

106. Two bodies of masses 4 kg and 5 kg are moving with equal momentum. Then the ratio of their respective kinetic energies is

- (A) 4:5
- (B) 2:1
- (C) 1:3
- (D) 5:4
- (E) 1:2

107. If  $r$  denotes the distance between the sun and the earth, then the angular momentum of the earth around the sun is proportional to

- (A)  $r^{\frac{3}{2}}$
- (B)  $r$
- (C)  $\sqrt{r}$
- (D)  $r^2$
- (E)  $r^3$

108. Moment of inertia of a hollow cylinder of mass  $M$  and radius  $r$  about its own axis is

- (A)  $\frac{2}{3}Mr^2$
- (B)  $\frac{2}{5}Mr^2$
- (C)  $\frac{1}{3}Mr^2$
- (D)  $\frac{1}{2}Mr^2$
- (E)  $Mr^2$

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Space for rough work

109. The escape speed of a body from the surface of earth (radius of earth =  $R_E$ ) is

- (A)  $\sqrt{gR_E}$  (B)  $\sqrt{\frac{gR_E}{2}}$  (C)  $gR_E$   
(D)  $\sqrt{2gR_E}$  (E)  $2gR_E$

110. The time period  $T$  of the moon of planet Mars (mass  $M_m$ ) is related to its orbital radius  $R$  ( $G$  = Gravitational constant) as

- (A)  $T^2 = \frac{4\pi^2 R^3}{GM_m}$  (B)  $T^2 = \frac{4\pi^2 GR^3}{M_m}$   
(C)  $T^2 = \frac{2\pi R^3 G}{M_m}$  (D)  $T^2 = 4\pi M_m GR^3$   
(E)  $T^2 = GM_m R^3$

111. Two wires of the same material and same length but diameters in the ratio 1:2 are stretched by the same force. The potential energy per unit volume of the two wires will be in the ratio

- (A) 1:2 (B) 4:1 (C) 2:1  
(D) 1:1 (E) 16:1

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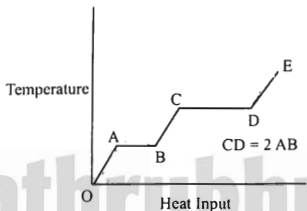
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112. A block of wood floats in water with  $\left(\frac{4}{5}\right)^{\text{th}}$  of its volume submerged. If the same block just floats in a liquid, the density of the liquid (in  $\text{kgm}^{-3}$ ) is
- (A) 1250 (B) 600 (C) 400  
(D) 800 (E) 750
113. If  $T$  is the surface tension of a liquid, the energy needed to break a liquid drop of radius  $R$  into 64 drops is
- (A)  $6\pi R^2 T$  (B)  $\pi R^2 T$  (C)  $12\pi R^2 T$   
(D)  $8\pi R^2 T$  (E)  $4\pi R^2 T$
114. If the amount of heat given to a system is 35 J and the amount of work done on the system is 15 J, then the change in internal energy of the system is
- (A) -50 J (B) 20 J (C) 30 J  
(D) 50 J (E) -20 J

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Space for rough work

115. A solid material is supplied with heat at constant rate and the temperature of the material changes as shown. From the graph, the FALSE conclusion drawn is



- (A) AB and CD of the graph represent phase changes  
 (B) AB represents the change of state from solid to liquid  
 (C) latent heat of fusion is twice the latent heat of vaporization  
 (D) CD represents change of state from liquid to vapour  
 (E) latent heat of vaporization is twice the latent heat of fusion
116. When the temperature of a rod increases from  $t$  to  $t+\Delta t$ , its moment of inertia increases from  $I$  to  $I+\Delta I$ . If  $\alpha$  be the coefficient of linear expansion of the rod, then the value of  $\frac{\Delta I}{I}$  is
- (A)  $2\alpha\Delta t$       (B)  $\alpha\Delta t$       (C)  $\frac{\alpha\Delta t}{2}$       (D)  $\frac{\Delta t}{\alpha}$       (E)  $\frac{\Delta t}{2\alpha}$
117. The motion which is NOT simple harmonic is
- (A) vertical oscillations of a spring  
 (B) motion of simple pendulum  
 (C) motion of a planet around the sun  
 (D) oscillation of liquid column in a U-tube  
 (E) vertical oscillation of a wooden plank floating in a liquid

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Space for rough work

118. A simple pendulum of frequency  $n$  falls freely under gravity from certain height from the ground level. Its frequency of oscillation will
- (A) remain unchanged
  - (B) be greater than  $n$
  - (C) be less than  $n$
  - (D) become zero
  - (E) become infinity
119. Air is blown at the mouth of an open tube of length 25 cm and diameter 2 cm. If the velocity of sound in air is  $330 \text{ ms}^{-1}$ , then the emitted frequencies are (in Hz)
- (A) 660, 1320, 2640
  - (B) 660, 1000, 3300
  - (C) 302, 664, 1320
  - (D) 330, 990, 1690
  - (E) 330, 660, 990
120. Two sound waves travel in the same direction in a medium. The amplitude of each wave is  $A$  and the phase difference between the two waves is  $120^\circ$ . The resultant amplitude will be
- |                 |          |          |
|-----------------|----------|----------|
| (A) $\sqrt{2}A$ | (B) $2A$ | (C) $3A$ |
| (D) $4A$        | (E) $A$  |          |
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