WARNING	Any malpractice or any attempt to commit any kind of malpractice in the Examination will DISQUALIFY THE CANDIDATE.

PAPER – I   CHEMISTRY & PHYSICS-2015

Version Code	**A2**	Question Booklet Serial Number :

Time : 150 Minutes	Number of Questions : 120	Maximum Marks : 480

Name of Candidate	
Roll Number	
Signature of Candidate	

INSTRUCTIONS TO THE CANDIDATE

1. **Please ensure that the VERSION CODE shown at the top of this Question Booklet is the same as that shown in the Admit card 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 Admit card. **THIS IS VERY IMPORTANT.**

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 3 in the OMR Answer Sheet.

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 **Most Appropriate Answer**. Mark the bubble containing the letter corresponding to the 'Most Appropriate Answer' in the OMR Answer Sheet, by using either **Blue or Black ball-point pen only**.

4. **Negative Marking:** 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 FOUR marks. ONE 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.

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.

IMMEDIATELY AFTER OPENING THIS QUESTION BOOKLET, THE CANDIDATE SHOULD VERIFY WHETHER THE QUESTION BOOKLET ISSUED CONTAINS ALL THE 120 QUESTIONS IN SERIAL ORDER. IF NOT, REQUEST FOR REPLACEMENT.

DO NOT OPEN THE SEAL UNTIL THE INVIGILATOR ASKS YOU TO DO SO.

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1. The element responsible for the neuromuscular function in the body is

    (A) Calcium   (B) Magnesium   (C) Potassium

    (D) Sodium   (E) Manganese

2. The salt of an alkali metal gives yellow colour in the flame test. Also its aqueous solution gives an insoluble white precipitate with barium chloride in acid medium. The salt is

    (A) NaCl   (B) K_2SO_4 (C) Na_2SO_4

    (D) Li_2SO_4 (E) $NaNO_3$

3. The oxoacid of phosphorus that reduces silver nitrate into metallic silver is

    (A) H_3PO_2 (B) $H_4P_2O_6$ (C) H_3PO_4

    (D) $H_4P_2O_7$ (E) $(HPO_3)_n$

4. The compound that is used in nuclear industry as protective shields and control rods is

    (A) metal carbonates   (B) metal chlorides   (C) metal oxides

    (D) metal hydroxides   (E) metal borides

Space for rough work

5. Which of the following oxides of nitrogen contains N–O–N bond?

(A) Dinitrogen oxide
(B) Nitrogen monoxide
(C) Dinitrogen pentoxide
(D) Dinitrogen trioxide
(E) Dinitrogen tetroxide

6. Which of the following transition metals of $3d$ series has the lowest melting point?

(A) Ti(Z=22)
(B) V(Z=23)
(C) Cr(Z=24)
(D) Mn(Z=25)
(E) Fe(Z=26)

7. Which of the following ions has the same number of unpaired electrons as those present in V^{3+}?

(A) Ti^{3+}
(B) Fe^{3+}
(C) Ni^{2+}
(D) Cr^{3+}
(E) Mn^{2+}

8. Among the following actinide pairs, the maximum oxidation states is shown by

(A) U and Np
(B) Np and Pu
(C) Pu and Am
(D) U and Pa
(E) Th and Pu

9. Among the transition metals of $3d$ series, the one that has the highest negative M^{2+}/M standard electrode potential is

(A) Ti
(B) Cu
(C) Mn
(D) Ni
(E) Zn

Space for rough work

10. The enthalpies of solution for copper sulphate pentahydrate and anhydrous copper sulphate are respectively -11.7 and -65.5 kJ mol^{-1}. The hydration enthalpy of anhydrous copper sulphate is

   (A) 53.8 kJmol^{-1} (B) -9.8 kJmol^{-1} (C) -77.2 kJmol^{-1}

   (D) -53.8 kJmol^{-1} (E) 77.2 kJmol^{-1}

11. The standard enthalpy of formation of $NH_3(g)$ is -91.8 kJ mol^{-1}. The amount of heat required to decompose 34 g of $NH_3(g)$ into its elements is

   (A) 183.6 kJ   (B) 91.8 kJ   (C) 45.9 kJ

   (D) 137.7 kJ   (E) 275.4 kJ

12. Calculate the work done by 16 g of oxygen gas (assume ideal behavior) of molar mass 32 g mol^{-1} undergoing isothermal reversible expansion at 300 K from an initial volume of 2.5 L to the final volume of 25 L in litre atm.
   $(R = 8.2 \times 10^{-2}$ L atm. K^{-1} mol$^{-1})$

   (A) -56.64 (B) 28.32   (C) 113.28

   (D) 56.64   (E) -113.28

13. In which one of the following, the increase of pressure favours the backward reaction?

   (A) Formation equilibrium of ammonia from $N_2(g)$ and $H_2(g)$
   (B) Decomposition equilibrium of $HI(g)$ to $H_2(g)$ and $I_2(g)$
   (C) Synthesis of $SO_3(g)$ by contact process
   (D) Production of 'syngas' by coal gasification
   (E) Formation equilibrium of Fe_3O_4 by action of steam on iron

Space for rough work

14. At 800 K in a sealed vessel, for the equilibrium $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, the equilibrium concentrations of $N_2(g)$, $O_2(g)$ and $NO(g)$ are respectively 0.36×10^{-3}M, 4.41×10^{-3}M and 1.4×10^{-3}M. Then, the value of K_C for the reaction $NO(g) \rightleftharpoons \frac{1}{2}N_2(g) + \frac{1}{2}O_2(g)$ at 800 K is

(A) 1.1 (B) 0.9 (C) 3×10^3 (D) 9×10^{-3} (E) 0.33

15. The solubility product of a salt MX_2 in water is 4×10^{-12}. The concentration of M^{2+} ions in the aqueous solution of the salt is

(A) 1×10^{-4}M   (B) 4×10^{-4}M   (C) 16×10^{-6}M
(D) 2×10^{-4}M   (E) 12×10^{-2}M

16. Which one of the following species cannot act as both Bronsted acid and base?

(A) H_2O (B) HCO_3^- (C) HSO_4^-
(D) NH_2^- (E) NH_3

17. The correct equation for the degree of association 'α' of an associating solute, 'n' molecules of which undergoes association in solution, is

(A) $\alpha = \dfrac{n(i-1)}{1-n}$ (B) $\alpha = \dfrac{i(n-1)}{1+n}$ (C) $\alpha = \dfrac{i(1+n)}{1-n}$

(D) $\alpha = \dfrac{i(n+1)}{n-1}$ (E) $\alpha = \dfrac{n(1-i)}{1-n}$

Space for rough work

18. The vapour pressure of a solvent at 293 K is 100 mm Hg. Then the vapour pressure of a solution containing 1 mole of a strong electrolyte (AB_2) in 99 moles of the solvent at 293 K is (assume complete dissociation of solute)

(A) 103 mm Hg   (B) 99 mm Hg   (C) 97 mm Hg

(D) 101 mm Hg   (E) 98 mm Hg

19. The correct order of osmotic pressure of 0.01M aqueous solution of the following is

(A) Sucrose > CH_3COOH > KCl

(B) CH_3COOH > Sucrose > KCl

(C) Sucrose > KCl > CH_3COOH

(D) KCl > Sucrose > CH_3COOH

(E) KCl > CH_3COOH > Sucrose

20. Among the following elements, which one exhibits both positive and negative oxidation states?

(A) Cs   (B) Ne   (C) I

(D) F   (E) K

21. Choose the disproportionation reaction among the following redox reactions

(A) $3Mg(s) + N_2(g) \rightarrow Mg_3N_2(s)$

(B) $P_4(s) + 3NaOH(aq) + 3H_2O(l) \rightarrow PH_3(g) + 3NaH_2PO_2(aq)$

(C) $Cl_2(g) + 2KI(aq) \rightarrow 2\ KCl(aq) + I_2(s)$

(D) $Cr_2O_3(s) + 2Al(s) \rightarrow Al_2O_3(s) + 2Cr(s)$

(E) $2NaH(s) \rightarrow 2Na(s) + H_2(g)$

Space for rough work

22. Standard electrode potentials of three metals X, Y and Z are 0.52 V, − 2.87 V and − 0.44 V respectively. The   ucing power of these metals are

(A) X > Y > Z   (B) X > Z > Y   (C) Y > X > Z

(D) Z > X > Y   (E) Y > Z > X

23. In a first order reaction 80% of the reactant at an instant was reduced to 8% in 4606 seconds. The rate constant of the reaction is

(A) $2.303 \times 10^{-4}\, s^{-1}$ (B) $4.606 \times 10^{-3}\, s^{-1}$ (C) $5.000 \times 10^{-3}\, s^{-1}$

(D) $5.000 \times 10^{-4}\, s^{-1}$ (E) $4.606 \times 10^{-4}\, s^{-1}$

24. The decomposition of N_2O_5 in CCl_4 at 318 K is studied by monitoring the concentration of N_2O_5 in the solution. Initially the concentration of N_2O_5 is 2.4 mol L^{-1} and after 200 minutes, it is reduced to 2.00 mol L^{-1}. What is the rate of production of NO_2 during this period in mol L^{-1} min^{-1}?

(A) 4×10^{-3} (B) 2×10^{-3} (C) 1×10^{-3}

(D) 2×10^{-4} (E) 5×10^{-3}

25. In a first order reaction, the concentration of the reactant decreases from 0.6M to 0.3M in 30 minutes. The time taken for the concentration to change from 0.1M to 0.025M is

(A) 60 min.   (B) 30 min.   (C) 15 min.

(D) 50 min.   (E) 90 min.

Space for rough work

26. The correct ascending order of adsorption of the following gases on the same mass of charcoal at the same temperature and pressure is

(A) $CH_4 < H_2 < SO_2$ (B) $H_2 < CH_4 < SO_2$ (C) $SO_2 < CH_4 < H_2$

(D) $H_2 < SO_2 < CH_4$ (E) $CH_4 < SO_2 < H_2$

27. When H_2 and CO are reacted in the presence of Cu catalyst, the product/s obtained is/are

(A) methanol   (B) methanal   (C) methane and H_2O

(D) acetic acid   (E) ethanol

28. Which of the following statements is incorrect about physisorption?

(A) It is reversible in nature

(B) It forms multilayer

(C) It involves high activation energy

(D) The extent of physisorption decreases with increase of temperature

(E) It increases with increase in surface area

29. The compound $[Pt(NH_3)_2Cl_2]$ can exhibit

(A) linkage isomerism   (B) coordination isomerism

(C) optical isomerism   (D) geometrical isomerism

(E) ionization isomerism

30. Which one among the following is a homoleptic complex?

(A) Tris(ethane-1,2-diamine)cobalt(III) chloride

(B) Triamminetriaquachromium(III) chloride

(C) Diamminechloridonitrito-N-platinum(II)

(D) Dichloridobis(ethane-1,2-diamine)cobalt(III) chloride

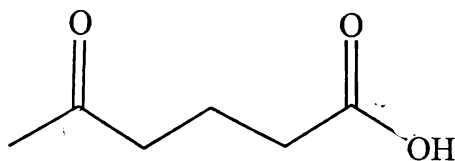(E) Pentamminecarbonatocobalt(III) chloride

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Space for rough work

31. The coordination number, oxidation number and the number of *d*-electrons in the metal ion of the complex [C⁣ (en)₂]Cl, are respectively (atomic number of Co=27)

(A) 4, 3 and 6 (B) 6, 2 and 6 (C) 6, 6 and 3

(D) 4, 2 and 6 (E) 6, 3 and 6

32. What is the IUPAC name of the following compound?

(A) Hexa-2,6-dienone-6-ol (B) 2-ketohexanoic acid

(C) 5-ketohexanoic acid (D) 2-oxohexanoic acid

(E) 5-oxohexanoic acid

33. The number of σ and π bonds present in 1,3-butadiene is respectively

(A) 9 and 2 (B) 8 and 2 (C) 9 and 3

(D) 9 and 1 (E) 8 and 1

34. Which one of the following is an aromatic compound?

(A) Cyclopentadienyl cation (B) Cycloheptatrienyl cation

(C) Cycloheptatrienyl anion (D) Cycloheptatriene

(E) Cyclopentadiene

Space for rough work

35. *n*-hexane on heating to 773 K at 10-20 atmospheric pressure in the presence of oxides of vanadium supported over alumina, yields

(A) 1-hexene   (B) 2-hexene   (C) benzene

(D) 2-methylpentane   (E) 2,2-dimethylbutane

36. Which one of the following is not an isomer of 3-methylbut-1-yne?

(A) Pent-1-yne   (B) Buta-1,3-diene   (C) Pent-2-yne

(D) Penta-1,3-diene   (E) 2-methylbuta-1,3-diene

37. The correct decreasing order of acidic character of hydrogen in ethane, ethene and ethyne is

(A) ethane > ethene > ethyne   (B) ethene > ethane > ethyne

(C) ethyne > ethane > ethene   (D) ethyne > ethene > ethane

(E) ethane > ethyne > ethene

38. On ozonolysis, one molecule of a hydrocarbon produces two molecules of ethanal and one molecule of ethanedial. The hydrocarbon could be

(A) 1, 3-hexadiene   (B) 1, 4-cyclohexadiene

(C) 1,4-hexadiene   (D) 2, 4-hexadiene

(E) 1, 3-cyclohexadiene

Space for rough work

39. Acid catalysed hydration of alkene is an example for

(A) Free radical substitution   (B) Nucleophilic substitution

(C) Nucleophilic addition   (D) Electrophilic addition

(E) Electrophilic substitution

40. Which one of the following undergoes nitration reaction most readily?

(A) Acetophenone   (B) Benzonitrile   (C) Benzaldehyde

(D) Benzoic acid   (E) Benzene

41. The total number of optical isomers possible for 2,3-dibromobutane is

(A) 2   (B) 4   (C) 0   (D) 3   (E) 8

42. Dehydration of which one of the following alcohols produces an alkene exhibiting cis-trans isomerism?

(A) Isopropyl alcohol   (B) Tertiary butyl alcohol   (C) *n*-butyl alcohol

(D) Neopentyl alcohol   (E) 3-pentanol

43. The products expected to be formed in the Wurtz reaction of a mixture of neopentyl bromide and isobutyl bromide are

(i) 2,2,4-trimethylpentane   (ii) 2,2,5,5-tetramethylhexane

(iii) 2,2,4,4-tetramethylhexane   (iv) 2,5-dimethylhexane

(v) 2,2,5-trimethylhexane

(A) (ii), (iii) and (v)   (B) (ii), (iv) and (v)   (C) (i), (iv) and (v)

(D) (i), (iii) and (v)   (E) (i), (ii) and (iv)

Space for rough work

44. Which one of the following organohalogen compounds when heated with alcoholic potassium hydroxide does not undergo dehydrohalogenation reaction?

(A) Secondary butyl chloride   (B) Isopropyl chloride

(C) Neopentyl chloride   (D) Isobutyl chloride

(E) Tertiary butyl chloride

45. By which one of the following reaction ketones cannot be prepared?

(A) Hydration of alkynes

(B) Hydrolysis of gem-dihalides

(C) Dry distillation of calcium carboxylates

(D) Stephen's reaction

(E) Ozonolysis of appropriately substituted alkenes

46. When a mixture of benzaldehyde and acetophenone is treated with dilute NaOH at 293 K, it forms

(A) 2,3-diphenyl propanal   (B) 1,1-diphenyl-propan-2-one-1-ol

(C) 1,3-diphenylprop-2-en-1-one   (D) 1,2-diphenylprop-2-en-1-one

(E) 1,3-diphenylprop-2-en-1-al

47. Glutaric acid is

(A) butane-1,4-dioic acid   (B) propane-1,3-dioic acid

(C) pentane-1,5-dioic acid   (D) hexane-1,6-dioic acid

(E) ethanedioic acid

Space for rough work

48. 4-methoxyacetophenone can be prepared from anisole by

(A) Reimer-Tiemann reaction   (B) Kolbe's reaction

(C) Friedel-Crafts reaction   (D) Wurtz reaction

(E) Cannizzaro reaction

49. The total number of structural isomers possible for an amine with molecular formula $C_4H_{11}N$ is

(A) 6   (B) 5   (C) 7   (D) 4   (E) 8

50. Which one of the following amine cannot be prepared by Gabriel phthalimide synthesis?

(A) Ethylamine   (B) Isopropylamine   (C) n-propylamine

(D) Ethylmethylamine   (E) Allylamine

51. Which one of the following amines forms a nonacidic and alkali insoluble product with p-toluenesulphonyl chloride?

(A) Tertiary butylamine   (B) n-butylamine   (C) Isobutylamine

(D) Diethylamine   (E) N, N-dimethyl ethylamine

52. Which of the following compounds is most basic?

(A) Aniline   (B) Cyclohexylamine   (C) o-nitroaniline

(D) o-toluidine   (E) p-methoxyaniline

Space for rough work

53. Glucose does not react with

   (A) hydroxylamine   (B) conc. HNO_3 (C) acetic anhydride
   (D) sodium bisulphite   (E) Br_2/H_2O

54. Which of the following is a water soluble vitamin?

   (A) Vitamin A   (B) Vitamin D   (C) Vitamin B_1
   (D) Vitamin E   (E) Vitamin K

55. The polymer used in the manufacture of squeeze bottles is

   (A) Polystyrene   (B) Teflon   (C) Polypropene
   (D) High density polythene (E) Low density polythene

56. The drug Tegamet is

   (A) Analgesic   (B) Anti-depressant   (C) Anaesthetic
   (D) Antacid   (E) Antibiotic

57. Which one of the following is a cationic detergent?

   (A) Sodium laurylsulphate
   (B) Cetyltrimethyl ammonium bromide
   (C) Sodium dodecylbenzene sulphonate
   (D) Glyceryl palmitate
   (E) Glyceryl oleate

Space for rough work

58. Which one of the following set of quantum numbers is possible?

(A) $n = 3, l = 3, m_l = -3, m_s = +1/2$

(B) $n = 2, l = 1, m_l = 2, m_s = -1/2$

(C) $n = 2, l = 0, m_l = 0, m_s = +1/2$

(D) $n = 1, l = 0, m_l = 0, m_s = 0$

(E) $n = 3, l = 2, m_l = 3, m_s = -1/2$

59. The mass of $CaCO_3$ required to react completely with 20 mL of 1.0M HCl as per the reaction, $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$ is (At. wt: Ca=40, C=12, O=16) ·

(A) 1 g   (B) 2 g   (C) 10 g   (D) 20 g   (E) 200 g

60. Which one of the following has maximum number of molecules?

(A) 16 g of O_2 (B) 16 g of NO_2 (C) 4 g of N_2

(D) 2 g of H_2 (E) 32 g of N_2

Space for rough work

61. The density of 2.0M solution of a solute is 1.2 g mL^{-1}. If the molecular mass of the solute is 100 g mol^{-1}, then the molality of the solution is

(A) 2.0 m   (B) 1.2 m   (C) 1.0 m

(D) 0.6 m   (E) 2.4 m

62. Which of the following set of molecules contain the same number of lone pair electrons in the central atom?

(A) SO_2, ClF_3, BrF_3 (B) SF_4, NH_3, O_3 (C) ClF_3, XeF_2, H_2O

(D) H_2O, SF_4, NH_3 (E) NH_3, XeF_2, O_3

63. Which one of the following does not match with respect to the shape of the molecule?

(A) NH_3 - Trigonal pyramidal

(B) SF_4 - Tetrahedral

(C) H_2S - Bent

(D) ClF_3 - T-shape

(E) XeF_4 - Square planar

64. Find the pair that has the same bond order with diamagnetic and paramagnetic properties respectively

(A) F_2 and O_2 (B) N_2 and O_2^{2-} (C) Li_2 and B_2

(D) B_2 and O_2 (E) He and Ne

Space for rough work

65. In which one of the following compounds does the central atom obeys the octet rule?

(A) XeF_4 (B) $XeOF_2$ (C) SCl_2

(D) $AlCl_3$ (E) BF_3

66. Equal masses of He, O_2 and SO_2 are taken in a closed container. The ratio of the partial pressures of gases He, O_2 and SO_2 would be

(A) $1:2:8$ (B) $8:16:1$ (C) $16:8:1$

(D) $1:4:16$ (E) $16:2:1$

67. Which one of the following gases has the highest critical temperature?

(A) Nitrogen   (B) Ammonia

(C) Water vapour   (D) Carbon dioxide

(E) Hydrogen

68. Match the following

Compound		Magnetic Property
(a) NaCl	-	(i) Ferrimagnetic
(b) MnO	-	(ii) Paramagnetic
(c) $CrCl_3$	-	(iii) Ferromagnetic
(d) CrO_2	-	(iv) Diamagnetic
(e) $MgFe_2O_4$	-	(v) Antiferromagnetic

(A) (a) - (i), (b) - (iii), (c) - (ii), (d) - (v), (e) - (iv)

(B) (a) - (v), (b) - (ii), (c) - (iii), (d) - (i), (e) - (iv)

(C) (a) - (iii), (b) - (v), (c) - (ii), (d) - (i), (e) - (iv)

(D) (a) - (iv), (b) - (v), (c) - (ii), (d) - (iii), (e) - (i)

(E) (a) - (iv), (b) - (iii), (c) - (v), (d) - (ii), (e) - (i)

Space for rough work

69. What would be the IUPAC name for the element with atomic number 120?

(A) Ununbium   (B) Unnilbium   (C) Unnilunium

(D) Ununtrium   (E) Unbinilium

70. Among Mg, Mg^{2+}, Al and Al^{3+} which will have the largest and the smallest size respectively?

(A) Mg, Al^{3+} (B) Al^{3+}, Mg   (C) Mg^{2+}, Al

(D) Al, Mg^{2+} (E) Mg^{2+}, Al^{3+}

71. How does the electron gain enthalpies vary across a period and down a group?

(A) More positive across a period and less positive down a group

(B) More negative across a period and less negative down a group

(C) Less positive across a period and less negative down a group

(D) More positive across a period and less negative down a group

(E) Less negative across a period and more negative down a group

72. The halide of which alkaline earth metal is covalent and soluble in organic solvents?

(A) Be   (B) Mg   (C) Ca

(D) Sr   (E) Ba

Space for rough work

73. Gravitational potential energy of a body of mass m at a height of h above the surface of earth (M = mass of earth; R = radius of earth) is

(A) $\dfrac{GMm}{h}$

(B) $\dfrac{GMm}{(R+h)}$

(C) $\dfrac{-GM}{(R+h)}$

(D) $\dfrac{Gm}{(R+h)}$

(E) $-\dfrac{GMm}{(R+h)}$

74. A boat carrying a few number of big stones floats in a water tank. If the stones are unloaded into water, the water level

(A) rises till half the number of stones are unloaded and then begins to fall

(B) remains unchanged

(C) rises

(D) falls till half the number of stones are unloaded and then begins to rise

(E) falls

75. Two wires of same length and same material but of radii r and $2r$ are stretched by forces F and f respectively to produce equal elongation. The ratio F to f is

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

76. Choose the correct statement

(A) Terminal velocities of rain drops are proportional to square of their radii

(B) Water proof agents decrease the angle of contact between water and fibres

(C) Detergents increase the surface tension of water

(D) Hydraulic machines work on the principle of Torricelli's law

(E) Venturimeter measures the flow speed of compressible fluids

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Space for rough work

77. If ΔU represents the increase in internal energy and W the work done by the thermodynamic system, then

   (A) $\Delta U = -W$ is an isothermal process

   (B) $\Delta U = W$ is an isothermal process

   (C) $\Delta U = -W$ is an adiabatic process

   (D) $\Delta U = W$ is an adiabatic process

   (E) $\Delta U = W$ is an isochoric process

78. If the energy input to a Carnot engine is thrice the work it performs then, the fraction of energy rejected to the sink is

   (A) $\dfrac{1}{3}$ (B) $\dfrac{1}{4}$ (C) $\dfrac{2}{5}$ (D) $\dfrac{2}{3}$ (E) $\dfrac{3}{4}$

79. The ratio of rms speed of an ideal gas molecules at pressure P to that at pressure 2P is

   (A) $1 : 2$ (B) $2 : 1$ (C) $1 : \sqrt{2}$ (D) $\sqrt{2} : 1$ (E) $1 : 1$

80. A pendulum of time period 2 s on earth is taken to another planet whose mass and diameter are twice that of earth. Then its time period on the planet is (in second)

   (A) $\dfrac{1}{2}$ (B) $2\sqrt{2}$ (C) $\dfrac{1}{\sqrt{2}}$ (D) 2 (E) $\sqrt{2}$

81. The physical quantity which remains constant in simple harmonic motion is

   (A) kinetic energy   (B) potential energy   (C) restoring force

   (D) displacement   (E) frequency

Space for rough work

82. Sound waves

    (A) can be polarized   (B) can exhibit diffraction

    (C) are transverse in nature   (D) can travel in free space

    (E) travel slower in liquids than in air

83. If a closed organ pipe has the same third harmonic frequency as that of an open organ pipe, then their respective lengths are in the ratio

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

84. A particle of mass 1.96×10^{-15} kg is kept in equilibrium between two horizontal metal plates having potential difference of 400 V separated apart by 0.02 m. Then the charge on the particle is (e = electronic charge)

    (A) $3e$ (B) $6e$ (C) $2e$ (D) $5e$ (E) $4e$

85. Two small spherical shells A and B are given positive charge of 9 C and 4 C respectively and placed such that their centres are separated by 10 m. If P is a point in between them where the electric field intensity is zero, then the distance of the point P from the centre of A is

    (A) 5 m   (B) 6 m   (C) 7 m   (D) 8 m   (E) 4 m

Space for rough work

86. Identify the wrong statement

(A) Charge is a vector quantity   (B) Current is a scalar quantity

(C) Charge can be quantised   (D) Charge is additive in nature

(E) Charge is conserved

87. When the rate of flow of charge through a metallic conductor of non uniform cross section is uniform, then the quantity that remains constant along the conductor is

(A) current density   (B) electric field   (C) electric potential

(D) drift velocity   (E) current

88. The resistance of a carbon resistor of colour code Red Red Green Silver is (in kΩ)

(A) $2200 \pm 5\%$ (B) $2200 \pm 10\%$ (C) $220 \pm 10\%$

(D) $220 \pm 5\%$ (E) $2200 \pm 1\%$

89. The slope of the graph showing the variation of potential difference V on x-axis and current on y-axis gives conductor's

(A) resistance   (B) resistivity

(C) reciprocal of resistance   (D) conductivity

(E) impedance

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90. Identify the mismatched pair

    (A) Hard magnet   -   Alnico

    (B) Soft magnet   -   Soft iron

    (C) Bar magnet   -   Equivalent solenoid

    (D) Electromagnet   -   Electric bells

    (E) Permanent magnet   -   Loud speaker

91. When the temperature of a magnetic material decreases, the magnetization

    (A) decreases in a diamagnetic material

    (B) decreases in a paramagnetic material

    (C) decreases in a ferromagnetic material

    (D) remains the same in a ferromagnetic material

    (E) remains the same in a diamagnetic material

92. The magnetic field at the centre of a circular coil carrying current I ampere is B. If the coil is bent into smaller circular coil of n turns, its magnetic field at the centre is B'. The ratio between B' and B is

    (A) $1 : 1$ (B) $n : 1$ (C) $n^2 : 1$

    (D) $2n : 1$ (E) $(n + 1) : 1$

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93. The magnetic flux linked with a circuit of resistance R changes by $\Delta\phi$ in a time Δt. Then the total quantity of charge Q that passes at any point in the circuit during the time Δt is

(A) $\dfrac{\Delta\phi}{R}$

(B) $\dfrac{1}{R}\dfrac{\Delta\phi}{\Delta t}$

(C) $R\dfrac{\Delta\phi}{\Delta t}$

(D) $\dfrac{\Delta\phi}{\Delta t}$

(E) $\dfrac{\Delta\phi}{R^2}$

94. In an LCR series resonant circuit, the capacitance is changed from C to 4C. For the same resonant frequency, the inductance should be changed from L to

(A) 2L

(B) $\dfrac{L}{2}$

(C) 4L

(D) $\dfrac{L}{4}$

(E) $\dfrac{L}{8}$

95. Changing magnetic fields can set up current loops in nearby metal bodies and the currents are called as

(A) eddy currents

(B) flux currents

(C) alternating currents

(D) leakage currents

(E) wattless currents

96. Ozone layer in the atmosphere absorbs

(A) radio waves

(B) infrared waves

(C) ultraviolet rays

(D) X-rays

(E) microwaves

Space for rough work

97. The magnifying power of a convex lens of focal length 10 cm when the image is formed at the near point is

(A) 6   (B) 5.5   (C) 4   (D) 3.5   (E) 2

98. The waves that require a medium to travel is

(A) infrared radiation   (B) ultraviolet radiation

(C) visible light   (D) X-rays

(E) ultrasound

99. In Young's double slit experiment, the locus of the point P lying in a plane with a constant path difference between the two interfering waves is

(A) a hyperbola   (B) a straight line   (C) an ellipse

(D) a parabola   (E) a circle

100. The ratio of the respective de Broglie wavelengths associated with electrons accelerated from rest with the voltages 100 V, 200 V and 300 V is

(A) $1:2:3$ (B) $1:4:9$ (C) $1:\dfrac{1}{\sqrt{2}}:\dfrac{1}{\sqrt{3}}$

(D) $1:\dfrac{1}{2}:\dfrac{1}{3}$ (E) $3:2:1$

Space for rough work

101. A radioactive source of half-life 2 hours emits radiation of intensity which is 64 times the permissible safe level. The minimum time in hours after which it would be possible to work safely with the source is
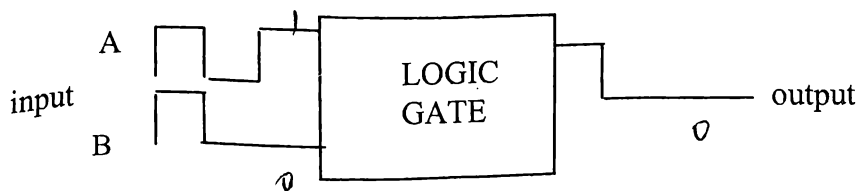
(A) 12   (B) 8   (C) 6   (D) 24   (E) 3

102. Nuclear fusion is not found in

(A) thermonuclear reactor   (B) hydrogen bomb

(C) energy production in sun   (D) atom bomb

(E) energy production in stars

103. The approximate ratio of nuclear mass densities of $^{197}_{79}Au$ and $^{107}_{47}Ag$ nuclei is

(A) $197:107$ (B) $47:79$ (C) $79:47$

(D) $1:1$ (E) $107:197$

104. Identify the gate used in the following diagram

(A) AND   (B) OR   (C) NAND

(D) NOR   (E) either NAND or NOR

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105. Acceptor level in *p*-type semiconductors lies

(A) nearer to the conduction band

(B) at the middle of conduction band and valence band

(C) within the valence band

(D) nearer to the valence band

(E) within the conduction band

106. The frequencies that are reflected and transmitted at ionospheric layer respectively are

(A) 3 kHz and 10 MHz   (B) 10 MHz and 40 MHz

(C) 10 MHz and 20 MHz   (D) 35 MHz and 70 MHz

(E) 100 Hz and 100 kHz

107. The gap between the frequency of the side bands in an amplitude modulated wave is

(A) twice that of the carrier signal

(B) twice that of the message signal

(C) the same as that of the message signal

(D) the same as that of the carrier signal

(E) the sum or difference of the frequencies of carrier and message signal

108. A transmitting antenna at the top of a tower has a height of 20 m. For obtaining 40 km as the maximum distance between the transmitter and receiver for satisfactory communication in LOS mode, the height of receiving antenna should be (radius of the earth $R = 64 \times 10^5$ m)

(A) 30 m   (B) 35 m   (C) 40 m   (D) 45 m   (E) 50 m

Space for rough work

109. The wrong unit conversion among the following is

(A) 1 angstrom $= 10^{-10}$ m

(B) 1 fermi $= 10^{-15}$ m

(C) 1 light year $= 9.46 \times 10^{15}$ m

(D) 1 parsec $= 3.08 \times 10^{16}$ m

(E) 1 astronomical unit $= 1.496 \times 10^{-11}$ m

110. Choose the wrong statement

(A) The motion of an object along a straight line is a rectilinear motion

(B) The speed in general is less than the magnitude of the velocity

(C) The slope of the displacement-time graph gives the velocity of the body

(D) The area under the velocity-time graph gives the displacement of the body

(E) The negative slope of speed-time graph indicates a retarded motion

111. The displacement of a particle as a function of time is shown in figure. It indicates that
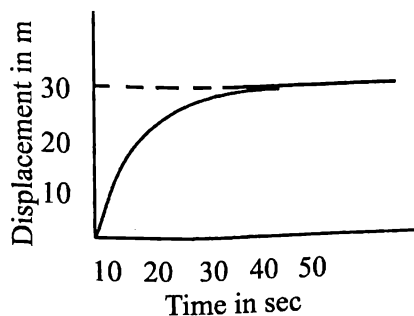
(A) the velocity of the particle is constant throughout

(B) the acceleration of the particle is constant throughout

(C) the particle starts with a constant velocity and is accelerated

(D) the particle starts from rest and is accelerated throughout

(E) the motion is retarded and finally the particle stops

Space for rough work

112. The range of a projectile is R when the angle of projection is 40°. For the same velocity of projection and range, the other possible angle of projection is

(A) 45°   (B) 50°   (C) 60°   (D) 40°   (E) 30°

113. The scalar quantity among the following is

(A) weight of body   (B) temperature gradient
(C) elementary area   (D) magnetic field strength
(E) electric potential

114. Which one of the following motions on a smooth plane surface does not involve force?

(A) Accelerated motion in a straight line
(B) Retarded motion in a straight line
(C) Motion with constant momentum along a straight line
(D) Motion along a straight line with varying velocity
(E) Motion in a circle with uniform speed

115. Pick out the wrong statement

(A) Newton's laws of motion hold good for both inertial and non-inertial frames
(B) During explosion, linear momentum is conserved
(C) Area under force-time graph gives the magnitude of impulse
(D) Force of friction is zero when no driving force is applied
(E) The apparent weight of a lift moving upwards with uniform velocity, equals its true weight

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116. Two bodies of different masses are moving with same kinetic energy. Then the ratio of their momenta is equal to the ratio of their

(A) masses
(B) square of masses
(C) square root of masses
(D) cube root of masses
(E) inverse of masses

117. Two bodies of masses 1 kg and 2 kg moving with same velocities are stopped by the same force. Then the ratio of their stopping distances is

(A) $1:2$
(B) $2:1$
(C) $\sqrt{2}:1$
(D) $1:\sqrt{2}$
(E) $1:\sqrt{3}$

118. If two circular discs A and B are of same mass but of radii r and $2r$ respectively, then the moment of inertia of A is

(A) the same as that of B
(B) twice that of B
(C) four times that of B
(D) half that of B
(E) one-fourth that of B

119. Choose the wrong statement

(A) The centre of mass of a uniform circular ring is at its geometric centre
(B) Moment of inertia is a scalar quantity
(C) Radius of gyration is a vector quantity
(D) For same mass and radius, the moment of inertia of a ring is twice that of a uniform disc
(E) Force in translational motion is analogous to torque in rotational motion

120. Orbital velocity of earth satellite does not depend on

(A) mass of the earth
(B) mass of the satellite
(C) radius of the earth
(D) acceleration due to gravity
(E) its height from the surface of earth

Space for rough work

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