SEAL

Test Booklet Number	Test - 1102	Roll Number
05700	**PHYSICS & CHEMISTRY**	

[Time : 2 Hours] [Maximum Marks : 400]

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you answer the questions given in this Test Booklet :

1. Answers to questions in this Test Booklet are to be given on a computerised **Answer Sheet** provided to the candidate **separately.**
2. Candidate must fill up Name, Category, Test Booklet Number, Subject Code and Roll Number in the answer sheet carefully as per instructions given.
3. This Test Booklet consists of 100 questions. All questions are compulsory and carry equal marks.
4. Each question in this Test Booklet has four possible alternative answers namely, (a), (b), (c) and (d), one of which is correct. Candidate should choose the correct answer against each question out of four alternative answers.
5. Candidate is instructed to answer the questions by **darkening (●)** with **Ball Point Pen** only in the circle bearing the correct answer.
6. Candidate should not attempt more than one answer in each question. More than one attempt in any form against a question shall be treated as incorrect.
7. Marking of answer other than darkening shall be cancelled and darkening should remain within the circle or otherwise computer shall not accept during evaluation of answer-script.
8. Rough work must not be done on the Answer Sheet. Use the blank space given in the Test Booklet for rough work.
9. Candidate is to hand over the Answer sheet to the Invigilator before leaving the Examination Hall.
10. **NEGATIVE MARKING** : Each question carries 4 (four) marks for correct response. For each incorrect response, 1 (one) mark will be deducted from the total score. More than one answer indicated against a question will be deemed as incorrect response and will be negatively marked.

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SET – I (PHYSICS)

1. The equation of state of a real gas can be expressed as $(P+\frac{a}{V^2})(V-b)=cT$, where P is the pressure, V is the volume, T is the absolute temperature and a, b and c are constants. What are the dimensions of a ?

(A) $M^0L^3T^{-2}$

(B) ML^5T^{-2}

(C) $M^0L^3T^0$

(D) $ML^{-2}T^5$

2. A quantity x is given by $\epsilon_0 L \frac{\Delta V}{\Delta t}$, where ϵ_0 is the permittivity of free space, L is a length, ΔV is a potential difference and Δt is a time interval. The dimensional formula for x is the same as that of

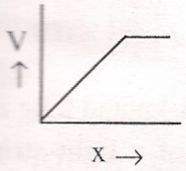
(A) resistance

(B) charge

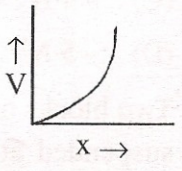
(C) voltage

(D) current

3.



(A)



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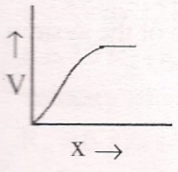

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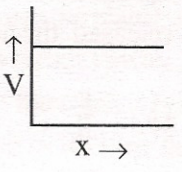


(D)

A drop of water falls in mustard oil. Which of the above curves expresses the relationship between the velocity v and distance x through which the drop falls ?

4. A force $\vec{F}=(2\hat{i}+3\hat{j})$ N acts at a point $\vec{r}=(\hat{i}+\hat{j})$ m. The component of the force perpendicular to $\vec{r}$ is

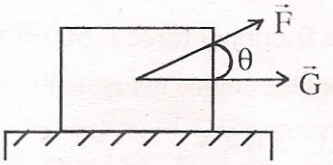
(A) $\frac{5}{2}(\hat{i}+\hat{j})$

(B) $\frac{5}{2}(\hat{i}-\hat{j})$

(C) $-\frac{1}{2}(\hat{i}-\hat{j})$

(D) $-\frac{1}{2}(\hat{i}+\hat{j})$

5.



Two forces $\vec{F}$ and $\vec{G}$ are applied to a box of mass 4 kg resting on a frictionless table (see figure above). When $\theta = 0$, the acceleration of the box is 3 m/s^2 and when $\theta = 90°$, the acceleration is 1 m/s^2. For $\theta = 180°$, the acceleration will be

(A) -2 m/s^2

(B) -1 m/s^2

(C) 1 m/s^2

(D) 2 m/s^2

6. A solid sphere rolls down from the top of an inclined plane. Its velocity on reaching the bottom of the plane is v. When the same sphere slides down from the top of the plane, its velocity on reaching the bottom is v'. The ratio v'/v is

(A) $\sqrt{3/5}$

(B) 1

(C) $\sqrt{\frac{7}{5}}$

(D) $\frac{3}{\sqrt{5}}$

7. An engine pulls a car of mass 1500 kg on a level road at a constant speed of 5 m/s. If the frictional force is 500 N, what power does the engine generate ?

(A) 5.0 kW

(B) 7.5 kW

(C) 10 kW

(D) 12.5 kW

8. After a completely inelastic collision, two particles of same mass and same initial speed move together with half the initial speed. The angle between the initial velocities of the particles is

(A) 150°

(B) 120°

(C) 90°

(D) 30°

9. A thin rod of length 58.8 m is held vertically with one end resting on the horizontal ground. At the instant it makes an angle 30° with the vertical, its angular velocity is (moment of inertial about centre of mass of the rod is $\frac{1}{12}$ mL^2 and $g = 9.8\ m/s^2$)

(A) 0.26 rad/s

(B) 0.23 rad/s

(C) 0.19 rad/s

(D) 0.15 rad/s

10. A particle located at $\vec{r} = \left(2\hat{i} - 3\hat{j} + 2\hat{k}\right)$ m is acted upon by a force $\vec{F} = \left(F_x\hat{i} + 7\hat{j} - 6\hat{k}\right)$ N. The corresponding torque is $\vec{\tau} = \left(4\hat{i} + 2\hat{j} - \hat{k}\right)$ N-m. The value of F_x is

(A) 3 N

(B) 1 N

(C) -4 N

(D) -5 N

11. Two blocks of masses 1 kg and 2 kg are suspended at the end of a light string passing over a frictionless pulley of mass 4 kg and radius 10 cm. When the masses are released, the acceleration of the system is

(A) $\frac{g}{9}$

(B) $\frac{g}{7}$

(C) $g/5$

(D) $g/3$

12. The distance between the sun and the earth is r and the earth takes time T to make one complete revolution around the sun. Assuming the orbit of the earth around the sun to be circular, the mass of the sun will be proportional to

(A) r^2 / T

(B) r^2 / T^2

(C) r^3 / T^2

(D) r^3 / T^3

13. A rocket is fired vertically and has a net upward acceleration of 4.9 m/s^2, when its mass including fuel is 10^3 kg. If the gases get exhausted at a speed of 1.47×10^4 m/s, the rate of mass ejection of the gases is (given $g = 9.8\ m/s^2$)

(A) 1 kg/s

(B) $\left(\frac{1}{3}\right)$ kg /s

(C) 5 kg/s

(D) 0.1 kg/s

14. An asteroid, headed towards the earth, has a velocity 12 km/s relative to the planet when it is 10 R_E (R_E is earth's radius) away. The velocity when it reaches the earth is (given $R_E = 6.37 \times 10^6$m, $G = 6.67 \times 10^{-11}\ m^3/kg.s^2$ and mass of earth $M_E = 6 \times 10^{24}$ kg)

(A) 1.0×10^4 m/s

(B) 1.2×10^4 m/s

(C) 1.4×10^4 m/s

(D) 1.6×10^4 m/s

15. A wooden block of density 670 kg/m^3 is floating with 80% of its volume submerged in an oil. The density of the oil is

(A) 3350 kg/m^3

(B) 837.5 kg/m^3

(C) 1340 kg/m^3

(D) 900 kg/m^3

16. 2 kg of ice is added to 10 kg of water at 10°C. The temperature of the mixture in thermal equilibrium is (Latent heat of fusion of ice = 80 KCal/kg)

(A) –10°C

(B) –5°C

(C) 0°C

(D) 5°C

17. A body cools from 25.1°C to 24.9°C in 2 minutes, when the temperature of surroundings is 15°C. How long will it take to cool from 20.1°C to 19.9°C ? Assume Newton's law of cooling to be valid.

(A) 1 minute

(B) 4 minutes

(C) 2 minutes

(D) 2.5 minutes

18. A Carnot's engine working between 300 K and 600 K has a work output of 800 J per cycle. How much heat energy is supplied to the engine from the source in each cycle ?

(A) 1400 J

(B) 1500 J

(C) 1600 J

(D) 1700 J

19. A composite slab consists of two slabs A and B of different materials but of the same thickness, placed one on top of the other. The thermal conductivities of A and B are K_1 and K_2 respectively. A steady temperature difference of 12°C is maintained across the composite slab. If $K_1 = K_{2/2}$, the temperature difference across slab A will be

(A) 4°C

(B) 8°C

(C) 12°C

(D) 16°C

20. The following four gases are at the same temperature. In which gas do the molecules have the maximum root mean square speed ?

(A) Hydrogen

(B) Oxygen

(C) Nitrogen

(D) Carbon dioxide

21. Two thermally insulated vessels 1 and 2 are filled with air at temperature (T_1, T_2), volume (V_1, V_2) and pressure (P_1, P_2) respectively. If the valve joining the two vessels is opened, the temperature inside the vessel at equilibrium will be

(A) $T_1 + T_2$

(B) $(T_1 + T_2)/2$

(C) $T_1T_2\,(P_1V_1 + P_2V_2) / (P_1V_1T_1 + P_2V_2T_2)$

(D) $T_1T_2\,(P_1V_1 + P_2V_2) / (P_1V_1T_2 + P_2V_2T_1)$

22. A wooden block is suspended from a spring. Its period for vertical oscillations is T. In another experiment the same apparatus is laid on a horizontal frictionless table with the free end of the spring fixed to a nail on the table. The block is pulled a little so as to stretch the spring and then released. The mass will execute a simple harmonic motion with period

(A) T

(B) 2T

(C) T/2

(D) zero

23. The particle of mass m moves along the x-axis under a potential given by $V(x) = V_0\,[1 - \cos(ax)]$, a and V_0 being positive constants. The period of small oscillations of the particle, on displacement from its position of equilibrium is

(A) $2\pi\sqrt{a^2V_0 / m}$

(B) $2\pi\sqrt{m} / a$

(C) $2\pi\sqrt{m/(2a^2V_0)}$

(D) $2\pi\sqrt{m/(a^2V_0)}$

24. Nine tuning forks are arranged in order of increasing frequency. Each tuning fork produces 4 beats per second when sounded with either of its neighbours. If the frequency of the 9th tuning fork is twice that of the first, what is the frequency of the first tuning fork ?

(A) 32 Hz

(B) 40 Hz

(C) 44 Hz

(D) 48 Hz

25. A conducting sphere A of volume V and having a charge Q is brought in contact with another uncharged sphere B of volume V/8 and then separated. After separation, the charges on spheres A and B will be respectively

(A) Q/2, Q/2

(B) 2Q/3, Q/3

(C) 4Q/5, Q/5

(D) 8Q/9, Q/9

26. Two thin coaxial circular wire rings A and B, each of radius 6 cm, are separated by a distance of 8 cm. The charges on the two rings are 1 nC and –1 nC respectively. The potential difference between the centres of the rings $V_B - V_A$ is

(A) –120 V

(B) 120 V

(C) –60 V

(D) 60 V

27. For an infinite linear chain of alternating positive and negative charges, each of magnitude Q and a distance d apart, the electrostatic energy of any one of them due to all of the others is

(A) $\frac{-\ln 2}{4\pi \epsilon_0} \cdot \frac{Q^2}{d}$

(B) $\frac{\ln 2}{4\pi \epsilon_0} \cdot \frac{Q^2}{d}$

(C) $\frac{-\ln 2}{2\pi \epsilon_0} \cdot \frac{Q^2}{d}$

(D) $\frac{\ln 2}{2\pi \epsilon_0} \cdot \frac{Q^2}{d}$

28. A current of density 2.7×10^6 Am^{-2} flows through a silver wire of radius 0.1 cm connected end to end to a copper wire of diameter 0.1 cm. The drift velocity of electrons in copper will be (atomic number of copper is 64, density of copper is 9×10^3 kg m^{-3} and each atom contributes one electron for conduction)

(A) 0.8 ms^{-1}

(B) 0.2 ms^{-1}

(C) 8×10^{-4} ms^{-1}

(D) 2×10^{-4} ms^{-1}

29. A 5°C rise in temperature is observed in a conductor by passing a current. When the current is doubled, the approximate rise in temperature will be

(A) 5°C

(B) 10°C

(C) 20°C

(D) 40°C

30. Two protons move parallel to each other, each with velocity $\vec{v}$ and radius vector joining them being normal to $\vec{v}$. Let the electric and magnetic force on one proton due to the other be $\vec{F}_E$ and $\vec{F}_B$ respectively. Then

(A) $\vec{F}_E = -\vec{F}_B$

(B) $\vec{F}_E = \vec{F}_B$

(C) $\vec{F}_E = -\left(\frac{c}{v}\right)^2 \vec{F}_B$

(D) $\vec{F}_E = -\left(\frac{c}{v}\right) \vec{F}_B$

31. A current I flows in the counter-clockwise direction along a thin wire in the shape of a regular n-gon in the horizontal plane. If the distance between the centre and any vertex of the n-gon is r, the magnetic induction $\vec{B}$ at the centre of the polygon is

(A) $n\mu_0 I \tan\left(2\pi/n\right) / 2\pi r$ vertically upwards

(B) $n\mu_0 I \tan\left(\pi/n\right) / 2\pi r$ vertically upwards

(C) $n\mu_0 I \tan\left(2\pi/n\right) / 2\pi r$ vertically downwards

(D) $n\mu_0 I \tan\left(\pi/n\right) / 2\pi r$ vertically downwards

32. A bar magnet has a magnetic moment of 2.5 J/T and is placed in a magnetic field of 0.2 T. Work done in turning the magnet from parallel to antiparallel position relative to field direction is

(A) 0.5 J

(B) 1.0 J

(C) 1.5 J

(D) 2.0 J

33. Curie temperature is the temperature below which

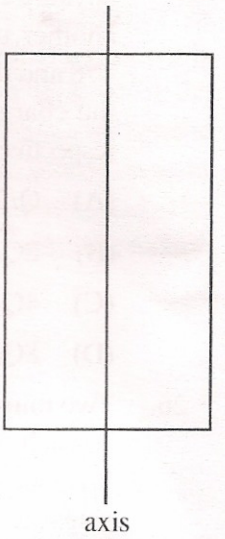
(A) every paramagnetic material becomes ferromagnetic

(B) every diamagnetic material becomes ferromagnetic

(C) some paramagnetic materials becomes ferromagnetic

(D) some diamagnetic materials becomes ferromagnetic

34. A rectangular loop of 10 turns, area of cross section 100 cm^2 and free to rotate about the axis passing through its middle, is placed in a uniform magnetic field B normal to the plane of the paper. If an alternating e.m.f. of r.m.s. value 220 V and frequency 50 hertz is to be generated, then B must be approximately equal to



(A) 10 T

(B) 7 T

(C) 1×10^{-3} T

(D) 1×10^{-4} T

35. In a series LCR circuit, L, C and R are each increased by a factor of K. Then the quality factor Q, the resonant frequency w_0 and the half bandwidth Δw change respectively to

(A) $Q/K, w_0/K, \Delta w/K$

(B) $Q/K, w_0/K, \Delta w$

(C) $Q/\sqrt{K}, w_0, \Delta w$

(D) $Q, w_0/K, \Delta w/K$

36. A coil of inductive reactance 31 Ω has a resistance of 8 Ω. It is placed in series with a condenser of capacitative reactance 25 Ω. The combination is connected to a.c. source of 110 V. The power factor of the circuit is

(A) 0.33

(B) 0.56

(C) 0.64

(D) 0.80

37. Read the assertion and reason carefully and mark the correct option :

Assertion (A) : Visible light is transverse in nature

Reason (R) : All electromagnetic waves are transverse in nature

(A) Both (A) and (R) are true and (R) is the correct explanation of (A)

(B) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(C) (A) is true but (R) is false

(D) (A) is false but (R) is true

38. There are three waves having wavelengths 10^{+1} m, 10^{-10} m and 10^{-7} m, respectively. Their respective names are

(A) visible, X-rays, γ-rays

(B) X-rays, γ-rays, visible

(C) X-rays, visible, radio-waves

(D) radio waves, X-rays, visible

39. An object is placed 100 cm away from a concave mirror of focal length 25 cm. A lens is placed between the two. When the lens is at a distance of 30 cm from the object, an inverted image of the object is formed in the object plane. The focal length of the lens is

(A) 60 cm

(B) – 60 cm

(C) 12 cm

(D) – 12 cm

40. In Young's double slit experiment, interference fringes are obtained on a screen placed at some distance from the slits using a monochromatic source of wavelength λ. When the screen is moved by 5×10^{-2} m towards the slit, the fringe width changes by an amount 2.5×10^{-5} m. If the distance between the slits is 10^{-3} m, then the value of λ is

(A) 4×10^{-7} m

(B) 4.5×10^{-7} m

(C) 5×10^{-7} m

(D) 5.5×10^{-7} m

41. The first diffraction minimum of light of wavelength $\lambda = 600$ nm appears at $\theta = 30°$, and coincides with the second diffraction maximum of light of wavelength λ'. The wavelength λ' is

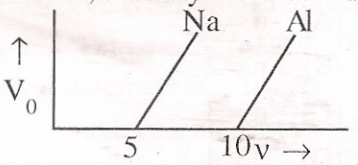
(A) 640 nm

(B) 560 nm

(C) 450 nm

(D) 400 nm

42. From the given figure describing photo-electric effect, one may infer correctly that



(A) both Na and Al have the same threshold frequency

(B) maximum kinetic energy for both metals depends linearly on the frequency

(C) the stopping potentials are different for Na and Al for the same change in frequency

(D) Al is a better photo-sensitive material than Na

43. What is the de-Broglie wavelength of an electron of energy 180 eV ? Mass of electron = 9×10^{-31} kg and Planck's constant = 6.6×10^{-34} Js.

(A) 0.5 Å

(B) 0.9 Å

(C) 1.3 Å

(D) 1.8 Å

44. The number of alpha particles scattered at 60° is 100 per minute (in an alpha particle scattering experiment). The number of alpha particles emitted per minute at 90° will be

(A) 50

(B) 30

(C) 25

(D) 10

45. Which energy state of doubly ionized lithium (Li^{++}) has the same energy as that of the ground state of hydrogen ? Given z for lithium = 3.

(A) n = 1

(B) n = 2

(C) n = 3

(D) n = 4

46. A nucleus ruptures into two nuclear parts which have their velocities in the ratio of 2 : 1. What will be the ratio of their nuclear sizes (radii) ?

(A) $2^{1/3} : 1$

(B) $1 : 2^{1/3}$

(C) $3^{1/2} : 1$

(D) $1 : 3^{1/2}$

47. The half-life of a radioactive isotope x is 50 years. It decays to another eliment y which is stable. The two elements x and y are found to be in the ratio of 1 : 15 in a sample of a given rock. The age of the rock is estimated to be

(A) $50 \times \log_e 15/0.693$ years

(B) $50 \times 0.693/\log_e 15$ years

(C) 100 years

(D) 200 years

48. If the input and output resistances in a common-base amplifier circuit are 400 Ω and 400 kΩ respectively, what is the voltage amplification when the emitter current is 2 mA and current gain $\alpha = 0.98$?

(A) 9.8

(B) 98

(C) 980

(D) 9800

49. The combination of gates shown below yields

(A) AND gate

(B) NAND gate

(C) NOR gate

(D) NOT gate

50. A receiving station on the ground is receiving a signal of frequency 5 MH_z from a transmitter at a height of 300 m above the surface of the earth (of radius 6.4×10^6 m) at a distance of 100 km from the receiver. Then the signal is coming via

(A) ground wave propagation

(B) sky wave propagation

(C) both ground and sky wave propagation

(D) neither ground wave nor sky wave propagation

51. Which of the following diatomic species is the least stable ?
(A) Li_2
(B) Be_2
(C) B_2
(D) C_2

52. The atomic numbers of the chemical species are given as subscripts. Which chemical species has the maximum number of unpaired electrons ?
(A) $_6C$
(B) $_{29}Cu$
(C) $_{30}Zn$
(D) $_{26}Fe$

53. Schottky defect
(A) increases the density of a crystal
(B) decreases the density of a crystal
(C) changes the density of a crystal depending upon the size of positive and negative ions in a crystal lattice
(D) does not change the density of a crystal

54. Which one of the following forms a network solid compound of covalently bonded atoms ?
(A) SiO_2
(B) NH_3
(C) NH_4Cl
(D) CO_2

55. ΔG° for the reaction $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ is $-212.3\ kJmol^{-1}$. The standard electrode potential for this cell is
(A) -0.11 V
(B) $+0.11$ V
(C) -1.1 V
(D) $+1.1$ V

56. For an ideal solution of two components, A and B, which of the following options is correct ?
(A) A – B interaction is stronger than A – A and B – B intractions
(B) A – A, B – B and A – B interactions are identical
(C) $\Delta H_{mixing} < 0$
(D) $\Delta V_{mixing} > 0$

57. For the thermodynamic function entropy, which one of the following statements is **not** true ?
(A) Entropy is a state function
(B) Entropy is a measure of randomness of a system
(C) Entropy decreases in an irreversible process
(D) Entropy is an extensive property

58. According to Arrhenius, $k = A\,e^{-Ea/RT}$ for a reaction where k = rate constant, A is Arrhenius constant, Ea is energy of activation of the reaction. When temperature of a first-order reaction is increased, then the **incorrect** statement is :
(A) The value of k increases
(B) The value of $e^{-Ea/RT}$ decreases
(C) Rate of reaction increases
(D) The value of $e^{-Ea/RT}$ increases

59. The molar solubility of $BaCO_3$ ($k_{sp} = 1.6 \times 10^{-9}$) in 0.10 M $BaCl_2$ solution is
(A) 1.6×10^{-10}
(B) 1.6×10^{-8}
(C) 4.5×10^{-5}
(D) 7.4×10^{-4}

60. What would be the freezing point of a 3.00 m aqueous solution of a nonvolatile, nonelectrolyte material ? The cryoscopic constant of water, $K_f = 1.86\ Kkgmol^{-1}$

(A) 5.6°C

(B) −5.6°C

(C) −3°C

(D) −1.86°C

61. For the process $O_2(g) \rightarrow 2O(g)$, $\Delta H° = +498$ kJ.

What would be the sign of ΔS_{rxn} and the conditions under which this reaction would be spontaneous ?

	ΔS_{rxn}	Spontaneous
(A)	positive	at low temperatures only
(B)	positive	at high temperatures only
(C)	negative	at high temperatures only
(D)	negative	at low temperatures only

62. When a gas expands from a volume V_1 to volume V_2 (with $V_2 > V_1$) is an insulated vessel against a constant external pressure P_{ext}, the process is called

(A) Isothermal reversible expansion

(B) Adiabatic reversible expansion

(C) Isothermal irreversible expansion

(D) Adiabatic irreversible expansion

63. An exothermic equilibrium reaction will

(A) go faster with a larger K_{eq} at higher temperatures

(B) go faster with a smaller K_{eq} at higher temperatures

(C) go slower with a larger K_{eq} at higher temperatures

(D) go slower with a smaller K_{eq} at higher temperatures

64. The standard (reduction) potentials of Zn, Al, H and Ag electrodes are –0.76, –1.66, 0.00 and +0.8 Volt respectively. Which one of the following combinations of electrodes would give a galvanic cell with a spontaneous reaction ?

(A) Hydrogen anode and silver cathode

(B) Ag anode and Zn cathode

(C) Hydrogen anode and aluminium cathode

(D) Zinc anode and aluminium cathode

65. In the context of protective power of lyophilic sol the correct statement is :

(A) It is measured in terms of gold number

(B) It is equal to coagulating power of ions

(C) It is determined by the size of its particle

(D) It is defined by Hardy-Schulze rule

66. On heating argentous sulphite alone, the main products are :

(A) $Ag_2SO_4 + Ag + SO_2$

(B) $Ag_2S_2O_6 + Ag$

(C) $Ag_2S_2O_3 + Ag_2O + O_2$

(D) $Ag_2S + Ag + SO_2 + O_2$

67. The following thermochemical equations are given :

$2C(s) + 2Hz(g) \rightarrow C_2H_4(g)\ \Delta H = 52.0\ kJ$

$C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(l)\ \Delta H = -88.0\ kJ$

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)\ \Delta H = -241.0\ kJ$

Find out the heat of formation of ethanol

(A) $381.0\ kJ\ mol^{-1}$

(B) $-381.0\ kJ\ mol^{-1}$

(C) $-277.0\ kJ\ mol^{-1}$

(D) $+277.0\ kJ\ mol^{-1}$

68. For which of the following chemical reactions $K_P < K_C$

(A) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

(B) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(C) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

(D) $N_2O_4(g) \rightleftharpoons N_2 + 2O_2(g)$

69. Which one of the following electrolytes will obey Ostwald dilution law ?

(A) Li (OH)

(B) Na (OH)

(C) K (OH)

(D) NH_4OH

70. B_2H_6 contains

(A) four 2-centre 2-electron bonds and two 3-centre 2-electron bonds

(B) three 2-centre 2-electron bonds and three 3-centre 2-electron bonds

(C) two 2-centre 2-electron bonds and four 3-centre 2-electron bonds

(D) six 2-centre 2-electron bonds and zero 3-centre 2-electron bonds

71. Identify the incorrect statement

(A) $Fe(CN)_6^{3-}$ reacts with H_2O_2 in alkaline solution to give O_2

(B) In acid solution H_2O_2 converts SO_3^{2-} to SO_4^{2-}

(C) Cl_2 reacts with H_2O_2 in alkaline solution to give Cl^-

(D) Catalytic decomposition of H_2O_2 solution is not a disproportionation reaction

72. Central atom of which of the following compounds / ions is Sp^3d hybridised ?

(A) ICl_2^+

(B) XeF_6

(C) BF_4^-

(D) SF_4

73. Following are the electron gain enthalpies in kJ/mol for halogens. Identify the value of Cl

(A) – 328

(B) – 349

(C) – 325

(D) – 295

74. Which of the following will be colourless ?

(A) $[Ti(H_2O)_6]^{3+}$

(B) $[CO(H_2O)_6]^{2+}$

(C) $[Ni(H_2O)_6]^{2+}$

(D) $[Zn(H_2O)_6]^{2+}$

75. Which one of the following transition metals exhibits the largest number of oxidation states in its compounds ?

(A) Vanadium (z = 23)

(B) Chromium (z = 24)

(C) Manganese (z = 25)

(D) Titanium (z = 22)

76. Which one of the following can act as a bidentate ligand in complex formations ?

(A) OH^-

(B) NH_3

(C) NO_2^-

(D) H_2O

77. The electronic configuration of a tripositive metal ion (M^{3+}) is $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $3d^5$ and its atomic mass is 56. The number of neutrons in its nucleus is :

(A) 30

(B) 26

(C) 34

(D) 38

78. The d-orbitals which are stabilized in an octahedral field are :

(A) d_{xy} and dz^2

(B) $d_{x^2-y^2}$ and dz^2

(C) d_{xy}, d_{yz} and d_{xz}

(D) d_{z^2} only

79. Which of the following is paramagnetic ?

(A) $[Ni(CN)_4]^{2-}$

(B) $[COF_6]^{3-}$

(C) $[CO(C_2O_4)_3]^{3-}$

(D) $[Fe(CN)_6]^{4-}$

80. In which of the following compounds the actinoid has the highest oxidation state ?

(A) $Li_5[NpO_6]$

(B) $(NH_4)_3[ThF_7]$

(C) $K_2[PaF_7]$

(D) $[UO_2(NO_3)_2(H_2O)_2]$

81. Which of the following has bridging O-atom ?

(A) N_2O

(B) N_2O_3

(C) N_2O_5

(D) N_2O_4

82. Choose the correct statement about the single to double to triple bonds between the two atoms

(A) the bond distance shortens and the bond strength increases

(B) the bond distance shortens and the bond strength decreases

(C) both the bond distance and bond strength increase

(D) both the bond distance and bond strength decrease

83. Regular use of which of the following fertilizers would increase the acidity of soil ?

(A) Superphosphate of lime

(B) Ammonium sulphate

(C) Potassium nitrate

(D) Urea

84. In the reaction

$$CH_3-CH=CH_2 + Br_2 \xrightarrow{773\ K}$$

the product is :

(A) $CH_3\ CH\ Br\ CH_2\ Br$

(B) $Br\ CH_2-CH=CH_2$

(C) $CH_3\ CH_2\ CH\ Br_2$

(D) $Br_2\ CH-CH=CH_2$

85. Peptide bond is :

(A) an amide bond

(B) an ester bond

(C) ether bond

(D) glycosidic bond

86. Which one of the following molecules is expected to have more solubility in water ?

(A) Salicylic acid

(B) O-hydroxy benzoic acid

(C) p-hydroxy benzoic acid

(D) 2, 6–dihydroxybenzoic acid

87. 1-Butyne and 2-butyne can be distinguished by :

(A) Chlorine water

(B) Bromine water

(C) $KMnO_4$

(D) Tollen's reagent

88. In aqueous solution the correct order of basicity of the following amines is :

(A) $R_2NH > RNH_2 > R_3N > NH_3$

(B) $NH_3 > R_2NH > RNH_2 > R_3N$

(C) $R_3N > NH_3 > R_2NH > RNH_2$

(D) $R_3N > R_2NH > RNH_2 > NH_3$

89. The non-reducing sugar is

(A) Sucrose

(B) Maltose

(C) Lactose

(D) Fructose

90. Among the following choices, the group that activates the benzene ring toward electrophilic aromatic substitution is

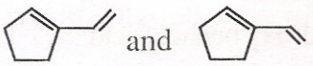
(A) – Br

(B) $-OCH_3$

(C) $-CF_3$

(D) $-CH_3$

91. The structures given below

 and

are –

(A) Structural isomers

(B) Enantiomers

(C) Diastereomers

(D) Identical

92. An SN^2 reaction at an asymmetric carbon leads to

(A) racemisation

(B) retention of configuration

(C) epimerisation

(D) inversion of configuration

93. Which of the following has the most acidic hydrogen ?

(A) Ethene

(B) Ethane

(C) Allene

(D) Ethyne

94. Which of the following orders of acid strength is correct ?

(A) $CH_3CH_2\underset{\displaystyle Cl}{\underset{|}{C}}H\,COOH < CH_3\underset{\displaystyle Cl}{\underset{|}{C}}HCH_2COOH < CH_2\underset{\displaystyle Cl}{\underset{|}{C}}H_2CH_2COOH$

(B) $CH_3CH_2\underset{\displaystyle Cl}{\underset{|}{C}}H\,COOH > CH_3\underset{\displaystyle Cl}{\underset{|}{C}}HCH_2COOH < CH_2\underset{\displaystyle Cl}{\underset{|}{C}}H_2CH_2COOH$

(C) $CH_3CH_2\underset{\displaystyle Cl}{\underset{|}{C}}H\,COOH > CH_3\underset{\displaystyle Cl}{\underset{|}{C}}HCH_2COOH > CH_2\underset{\displaystyle Cl}{\underset{|}{C}}H_2CH_2COOH$

(D) $CH_3\underset{\displaystyle Cl}{\underset{|}{C}}HCH_2COOH > CH_3CH_2\underset{\displaystyle Cl}{\underset{|}{C}}H\,COOH < CH_2\underset{\displaystyle Cl}{\underset{|}{C}}H_2CH_2COOH$

95. The major product formed in the reaction of toluene with bromine in the presence of peroxide is

(A) benzyl bromide

(B) 4-bromotoluene

(C) 2-bromotoluene

(D) 2, 4, 6–tribromotoluene

96. 1, 3 – Butadiene has :

(A) 6 σ, 2 π bonds

(B) 2 σ, 2 π bonds

(C) 9 σ, 2 π bonds

(D) 6 σ, 6 π bonds

97. The Sugar molecule present in DNA is :

(A) ribose

(B) 2-deoxytribose

(C) glucose

(D) fructose

98. Which of the following is a polyester ?

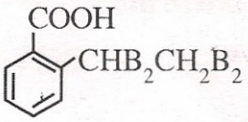
(A) Terylene

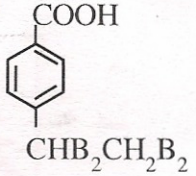
(B) Teflon

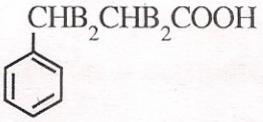
(C) Nylon-66

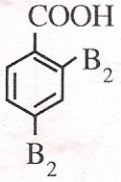
(D) Bakelite

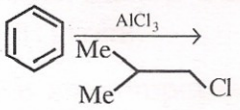
99. A compound A on heating with acetic anhydride in presence of sodium acetate forms compound B. B adds with bromine to form a dibromo derivative C. C is :

(A) 

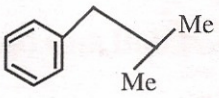
(B) 

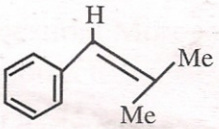
(C) 

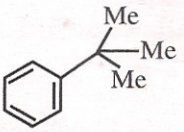
(D) 

100. 

The major product formed in the above reaction is

(A) 

(B) 

(C) 

(D)