

Test Booklet No.

KAILASH

110553454

Test Booklet Code

12

ENGLISH

Do not open this Test Booklet until you are asked to do so.
This Booklet contains 32 pages, including Rough Pages.



Important Instructions :

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on ORIGINAL Copy carefully with **blue/black** ball point pen only.
2. The test is of 3 hours duration and the Test Booklet contains 180 multiple-choice questions (4 options with a single correct answer) from **Physics, Chemistry and Biology (Botany and Zoology)**.
3. Wherever the symbols/constants are not mentioned, they are to be considered as per their standard meaning/value.
4. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.
5. Use **Blue/Black Ball Point Pen only** for writing particulars on this page/mark responses on the Answer Sheet.
6. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
7. On completion of the test, the candidate **must hand over the Answer Sheet (ORIGINAL and OFFICE Copy) to the Invigilator** before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.
8. The CODE for this Booklet is "12". Make sure to enter this Booklet code in the OMR Answer Sheet.

9. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.
10. Use of white fluid for correction is **not** permissible on the Answer Sheet.
11. Each candidate must show on demand his/her Admit Card to the Invigilator.
12. No candidate, without special permission of the Centre Superintendent or Invigilator, should leave his/her seat.
13. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign (with time) the Attendance Sheet **twice**. Cases, where a candidate has not signed the Attendance Sheet a second time, will be deemed not to have handed over the Answer Sheet and dealt with as an **Unfair Means case**.
14. Use of Electronic/Manual Calculator is prohibited.
15. The candidates are governed by all Rules and Regulation of the examination with regard to their conduct in the Examination Room/Hall. All cases of unfair means will be dealt with as per the Rules and Regulations of the examination along with Public Examinations (Prevention of Unfair Means) Act, 2024.
16. **No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.**
17. The candidates will write the Correct Test Booklet Code given in the Test Booklet/Answer Sheet in the Attendance Sheet.
18. If a candidate marks more than one answer for a question in the **OMR Answer Sheet**, it will be treated as incorrect and negative marking will be applicable.

Name of the Candidate (in Capitals): _____

Roll Number : in figures _____

: in words _____

Centre of Examination (in Capitals): _____

Candidate's Signature: _____

Invigilator's Signature: _____

Facsimile signature stamp of Centre Superintendent: _____

$$n = 100 \quad r = 5 \text{ cm} \quad \frac{4\pi n r}{2R}$$

1. A 100-turn closely wound circular coil of radius 5 cm has a magnetic field of $3.14 \times 10^{-3} \text{ T}$ at its centre. The current flowing through the coil, and the magnitude of the magnetic moment of this coil are, respectively :

(Take $\mu_0 = 4\pi \times 10^{-7} \text{ T m/A}$)

- (1) 2.5 A, 2 A m² (2) 2.5 A, 20 A m²
 (3) 2 A, 4 A m² (4) 2 A, 10 A m²

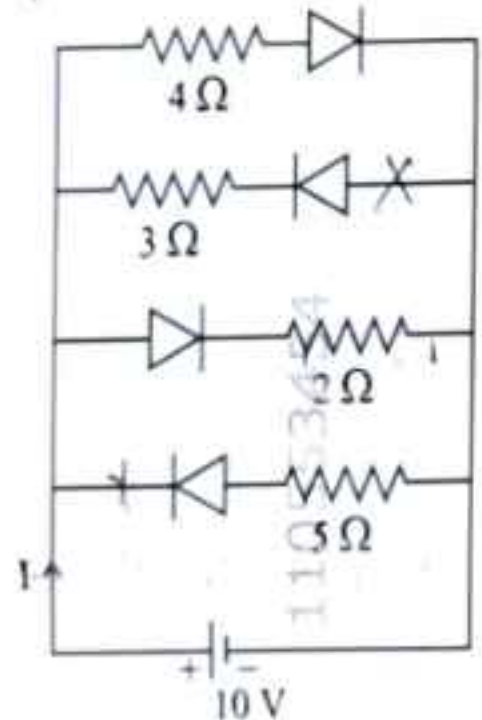
2. Match List I with List II :

List I	List II
A. $E = h\nu$	I. de Broglie wavelength
B. Diffraction and Interference	II. Particle nature of light
C. $\lambda = h/p$	III. Wave nature of light
D. Compton effect	IV. Energy of photon

Choose the correct answer from the options given below :

- (1) A-IV, B-III, C-I, D-II
 (2) A-I, B-IV, C-III, D-II
 (3) A-IV, B-I, C-II, D-III
 (4) A-IV, B-III, C-II, D-I

3. The current I in the circuit shown below is :
 (All diodes are ideal and identical)



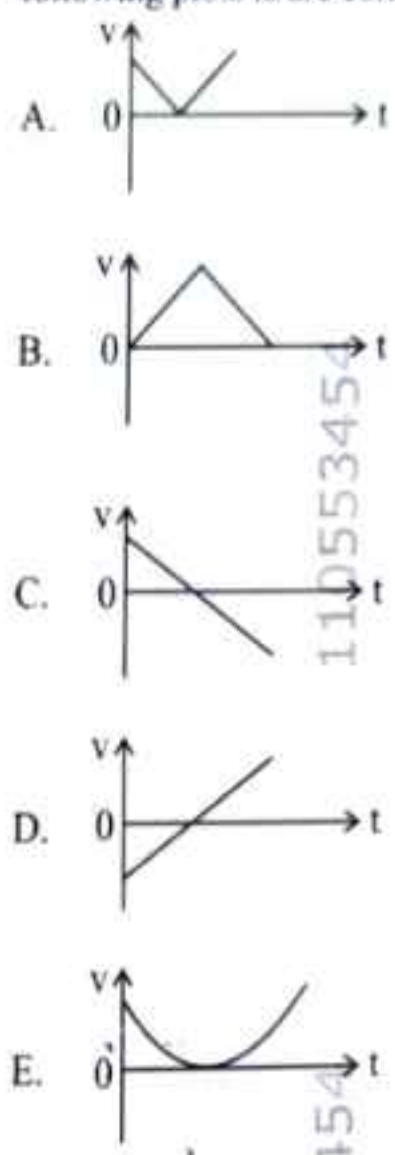
Handwritten calculations:
 $\frac{4 \times 3}{4+3} = \frac{12 \times 2}{7} = \frac{24}{7}$
 $\frac{9 \times 2}{4+2} = \frac{18}{3} = 6$
 $\frac{44}{12+14} = \frac{44}{26} = \frac{22}{13}$
 $\frac{44}{22} = 2$
 $\frac{26}{13} = 2$

- (1) $\frac{5}{3} \text{ A}$ (2) $\frac{15}{2} \text{ A}$
 (3) $\frac{1}{3} \text{ A}$ (4) $\frac{5}{9} \text{ A}$

4. The speed of light in vacuum is taken as unity. light takes 6 min 40 s to reach the Earth from the Sun, the distance between the Sun and the Earth in new unit is :

- (1) 3×10^8 (2) 3×10^{10}
 (3) 400 (4) 500

5. The following plots show variation of velocity (v) with time (t), of a ball thrown vertically upward, and falling back. Which of the following plots is/are correct ?



- (1) C only (2) A and E only
 (3) D only (4) B only

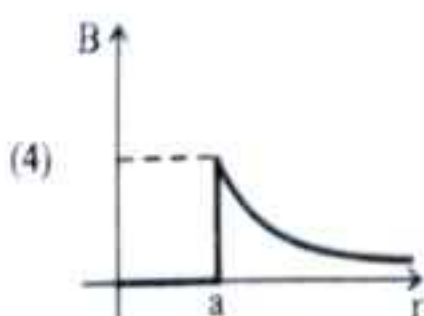
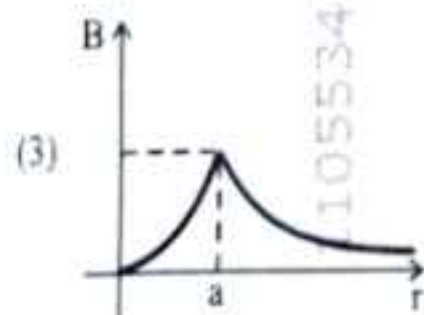
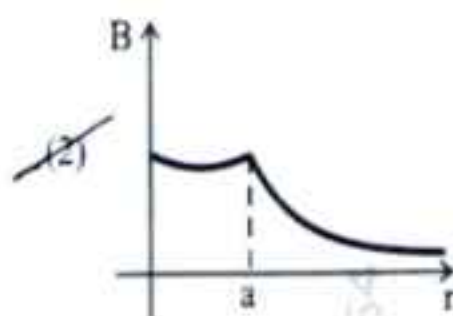
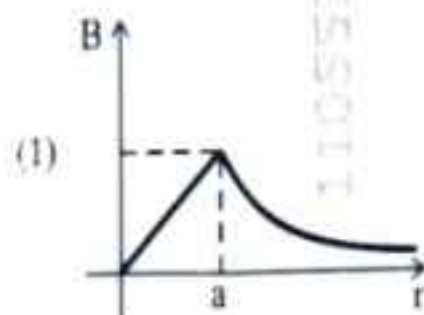
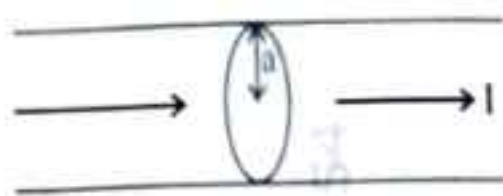
6. In a vernier callipers, 20 VSD coincide with 16 MSD (each division of length 1 mm). The least count of the vernier callipers is :

- (1) 0.01 cm (2) 0.1 cm
 (3) 0.02 cm (4) 0.2 cm

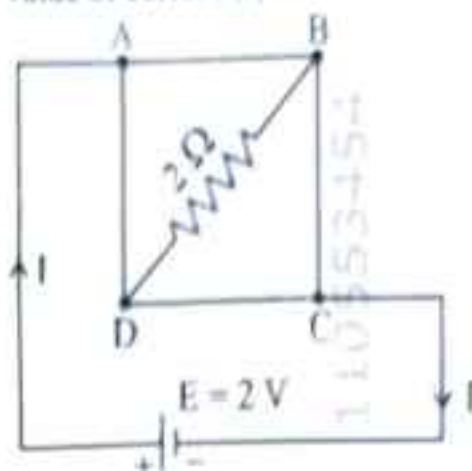
7. An ac circuit contains a resistance of $1\text{ k}\Omega$, a capacitor of $0.1\text{ }\mu\text{F}$ and an inductor of 1 mH connected in series. The resonance frequency of the circuit is approximately :

(1) 10.1 kHz (2) 20.7 kHz
(3) 15.9 kHz (4) 13.5 kHz

8. The figure given below shows a long straight solid wire of circular cross-section of radius ' a ' carrying steady current I . The current I is uniformly distributed across its cross-section. The plot which correctly represents the variation of magnetic field (B) with distance (r) from the axis of the conductor in the region is :



9. A uniform metallic wire having resistance $4\text{ }\Omega$ is bent to form a square loop (ABCD) (see figure). A resistance of $2\text{ }\Omega$ is connected between points B and D and a battery of 2 V is connected across points A and C as shown in the figure. Now the value of current (I) is :



(1) 2 A (2) 4 A
(3) 8 A (4) 4.5 A

10. An unknown nucleus has a nuclear density of $2.29 \times 10^{17}\text{ kg/m}^3$ and mass of $19.926 \times 10^{-27}\text{ kg}$. Its mass number A is approximately :

(Take $R_0 = 1.2 \times 10^{-15}\text{ m}$, $4\pi = 12.56$)

(1) 12 (2) 19
(3) 20 (4) 16

11. A rectangular wire loop of sides 8 cm and 3 cm with a small cut, is moving out of a region of uniform magnetic field of magnitude 0.3 T directed normal to the plane of the loop. The emf developed across the cut, if the velocity of the loop is 2 cm s^{-1} , in a direction normal to the shorter side of the loop, will be :

(1) $1.8 \times 10^{-4}\text{ volt}$ (2) $1.2 \times 10^{-4}\text{ volt}$
(3) $1.3 \times 10^{-4}\text{ volt}$ (4) $4.8 \times 10^{-4}\text{ volt}$

12. A galvanometer of resistance $100\text{ }\Omega$ gives full scale deflection for a current of 1 mA . It is converted into an ammeter of range $0 - 10\text{ A}$. The shunt required is :

(1) $0.01\text{ }\Omega$ (2) $0.10\text{ }\Omega$
(3) $0.001\text{ }\Omega$ (4) $1.0\text{ }\Omega$

13. In Young's double slit experiment, using monochromatic light of wavelength λ , the intensity of light at a point on the screen where the path difference is λ is K units. The intensity of light at a point where the path difference is $\frac{\lambda}{3}$ will be :

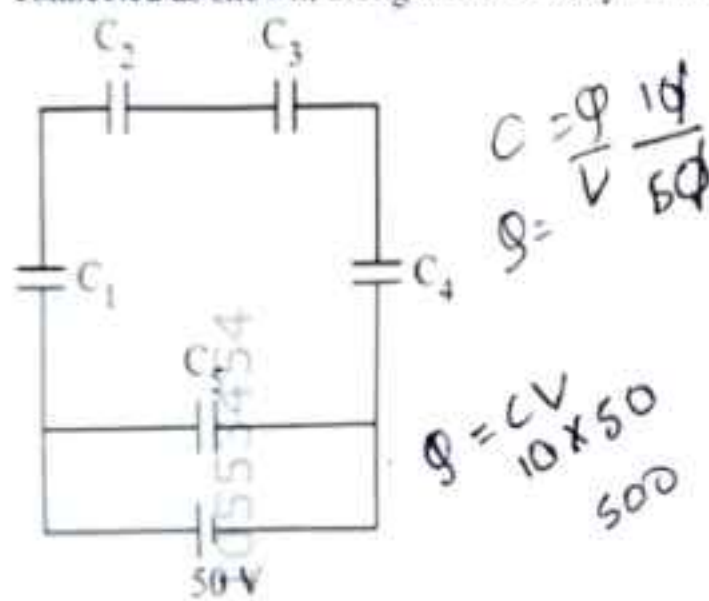
- (1) $\frac{K}{4}$ (2) K
(3) $\frac{K}{2}$ (4) $2K$

14. The magnitude and direction of the acceleration produced in a body of mass 5 kg when two mutually perpendicular forces 8 N and 6 N act on it, are respectively :

- (1) 2 m s^{-2} ; $\tan^{-1}(3/4)$ with 6 N force
(2) 2 m s^{-2} ; $\tan^{-1}(4/3)$ with 8 N force
(3) 2 m s^{-2} ; $\tan^{-1}(3/4)$ with 8 N force
(4) 20 m s^{-2} ; $\tan^{-1}(4/3)$ with 8 N force

15. Five capacitors of capacitances

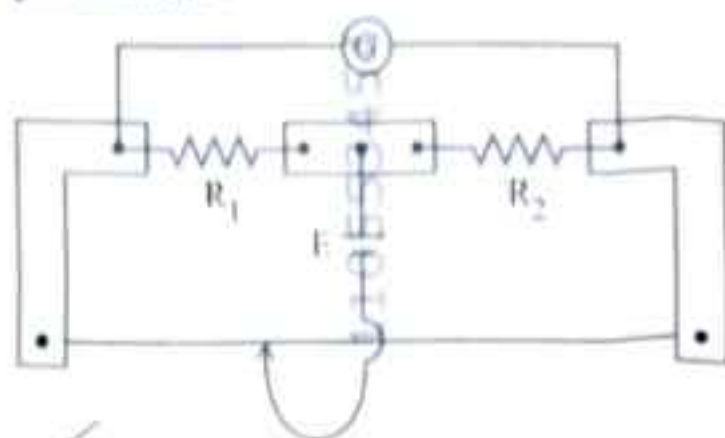
$C_1 = C_2 = C_3 = C_4 = 10 \mu\text{F}$ and $C_5 = 2.5 \mu\text{F}$ are connected as shown, along with a battery of 50 V .



The equivalent capacitance and the charges on each capacitor respectively are :

- (1) $5 \mu\text{F}$, $125 \mu\text{C}$ on all capacitors
(2) $5 \mu\text{F}$, $250 \mu\text{C}$ on all capacitors
(3) $4 \mu\text{F}$, $250 \mu\text{C}$ on C_1 to C_4 and $125 \mu\text{C}$ on C_5
(4) $5 \mu\text{F}$, $125 \mu\text{C}$ on C_1 to C_4 and $25 \mu\text{C}$ on C_5

16. In a metre bridge experiment (see figure), the positions of the cell, E , and galvanometer, G , are interchanged. We shall observe in the galvanometer :



- (1) Only the right-sided deflection
(2) Only the left-sided deflection
(3) There will be no deflection irrespective of the position of the jockey
(4) Both right-sided and left-sided deflection and at balance point, no deflection

17. The power of a crane, which lifts a mass of 1000 kg to a height of 20 m in 10 s is : ($g = 9.8 \text{ m/s}^2$)

- (1) 19.6 W (2) 39.2 W
(3) 39.2 kW (4) 19.6 kW

18. Match List I with List II :

List I	List II
A. Young's Modulus	I. $\frac{\Delta d}{\Delta L} \left(\frac{L}{d} \right)$
B. Compressibility	II. $\frac{FL}{A(\Delta L)}$
C. Bulk Modulus	III. $-\frac{1}{\Delta P} \left(\frac{\Delta V}{V} \right)$
D. Poisson's Ratio	IV. $-P \left(\frac{V}{\Delta V} \right)$

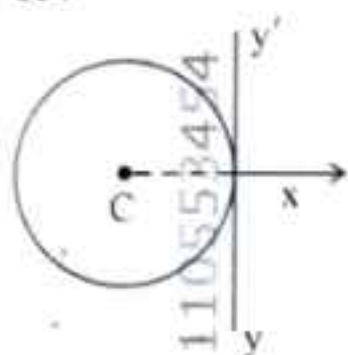
Choose the **correct** answer from the options given below :

- (1) A-I, B-IV, C-III, D-II
(2) A-IV, B-I, C-II, D-III
(3) A-III, B-II, C-I, D-IV
(4) A-II, B-III, C-IV, D-I

19. In a concave lens, a ray of light emanating from the object parallel to the principal axis of the lens, after refraction :

- (1) emerges parallel to the principal axis.
- (2) appears to diverge from the first principal focus.
- (3) passes through $2F$, which is the radius of curvature of the lens.
- (4) passes through the second principal focus.

20. A thin wire of length ' L ' and linear mass density ' m ' is bent into a circular ring (in x - y plane) with centre ' C ' as shown in figure. The moment of inertia of the ring about an axis yy' will be :



- (1) $\frac{3 mL^3}{8 \pi^2}$
- (2) $\frac{3 mL^3}{8 \pi}$
- (3) $\frac{3 mL^2}{8 \pi^2}$
- (4) $\frac{3 mL^2}{8 \pi}$

21. Each side of a metallic cube of mass 5.580 kg is measured to be 9.0 cm. Keeping the significant figures in view, the density of the material of the cube can be best expressed as $X \times 10^3 \text{ kg m}^{-3}$, where the value of X is :

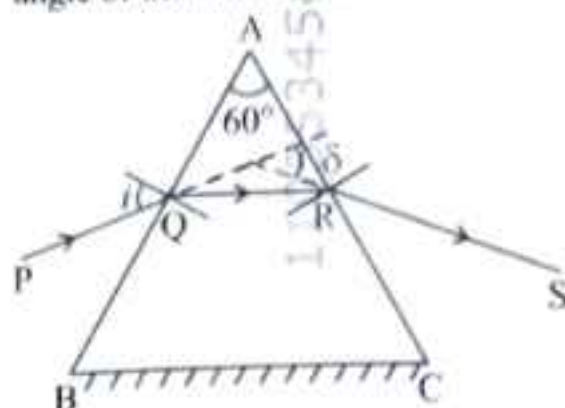
- (1) 7.654
- (2) 7.7
- (3) 7.65
- (4) 7.6

22. For a travelling harmonic wave

$y(x, t) = 2.0 \cos 2\pi(10t - 0.0080x + 0.35)$, where x and y are in cm and t in s. The phase difference between oscillatory motion of two points separated by a distance of 0.5 m is :

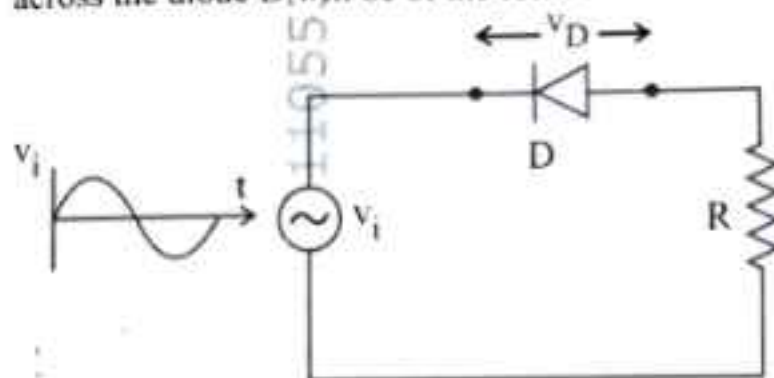
- (1) $8 \pi \text{ rad}$
- (2) $0.08 \pi \text{ rad}$
- (3) $0.008 \pi \text{ rad}$
- (4) $0.8 \pi \text{ rad}$

23. A ray of monochromatic light is passing through an equilateral prism (ABC) as shown in the figure. The refracted ray (QR) is parallel to its base (BC) and the angle of incidence (i) is 50° . Then the angle of deviation (δ) is :



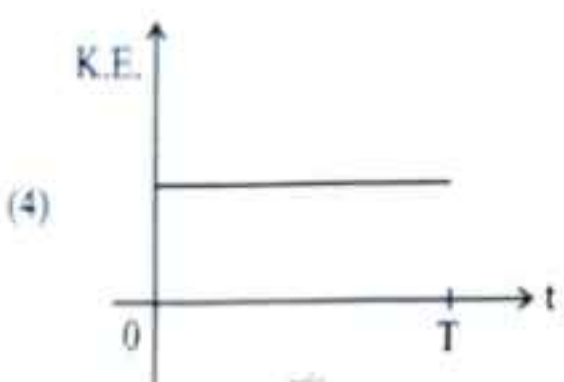
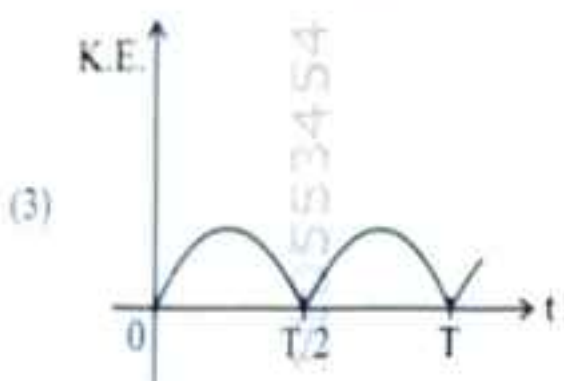
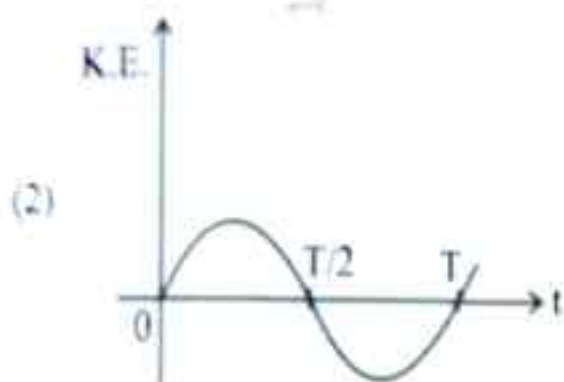
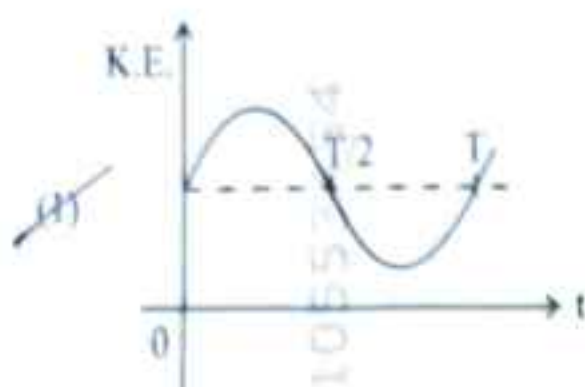
- (1) 40°
- (2) 45°
- (3) 55°
- (4) 35°

24. In the circuit shown below, the voltage appearing across the diode D will be of the form :



- (1)
- (2)
- (3)
- (4)

25. For a simple pendulum, having time period T , the variation of kinetic energy (K.E.) with time (t) is represented by :



26. A resistor is connected to a battery of 12 V emf and internal resistance $2\ \Omega$. If the current in the circuit is 0.6 A, the terminal voltage of the battery is :

(1) 10 V (2) 10.8 V (3) 12 V (4) 1.2 V

27. The amount of work done to raise a mass ' m ' from the surface of the Earth to a height equal to the radius of the Earth ' R ', will be :

(1) $2mgR$ (2) mgR
(3) $mg\frac{R}{4}$ (4) $mg\frac{R}{2}$

28. An electric heater supplies heat to a system at a rate of 100 W. If the system performs work at a rate of 75 J/s, then the rate at which internal energy increases will be :

(1) 125 W (2) 100 W
(3) 25 W (4) 75 W

29. A room heater is rated 400 W, 220 V. If the supply voltage drops to 200 V, what will be the power consumed (approximately)?

(1) 121 W (2) 331 W
(3) 200 W (4) 400 W

30. When a ruler falls vertically, 5 different persons catch it with different reaction times.

($g = 9.8\text{ m s}^{-2}$)

- A. Person A has reaction time of 0.20 s
B. Person B has reaction time of 0.22 s
C. Person C has reaction time of 0.18 s
D. Person D has reaction time of 0.19 s
E. Person E has reaction time of 0.21 s

What is the correct order of the distance travelled by the ruler for each person?

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

31. Consider two uncharged capacitors of equal capacitance 200 pF. One of them is charged by a 100 V supply and disconnected. Now this capacitor is connected to the uncharged capacitor. The amount of electrostatic energy lost in the process is :

(1) $1.0 \times 10^{-6}\text{ J}$ (2) $0.5 \times 10^{-6}\text{ J}$
(3) 0.5 J (4) 1.0 J

32. Savitha, a XI standard student, while conducting an experiment to determine the effective length of a simple pendulum L , notes down the data of time taken to complete 30 oscillations as 60 s and hence calculates the length of the simple pendulum as :

(Take $\pi^2 = 9.8$ and $g = 9.8 \text{ m/s}^2$)

- (1) 2 m (2) 0.75 m
(3) 1.5 m (4) 1 m

33. The peak value of an alternating current is 5 A and frequency is 60 Hz. How long will the current, starting from zero, take to reach the peak value ?

- (1) $\frac{1}{240}$ s (2) $\frac{1}{30}$ s

- (3) $\frac{1}{120}$ s (4) $\frac{1}{60}$ s

34. In interference and diffraction, the light energy is redistributed. If it reduces in one region, producing a dark fringe, it increases in another region, producing a bright fringe.

A. As there is no gain or loss of energy, these phenomena are consistent with the principle of conservation of energy.

B. Diffraction and interference are characteristics exhibited only by light waves.

Choose the correct answer from the options given below :

- (1) A is true, but B is false
(2) A is true and B is also true
(3) A is false, but B is true
(4) Both A and B are false

35. A box of mass 15 kg is kept on the floor of a stationary trolley. The coefficient of static friction between the box and the trolley is 0.12. Keeping the box in stationary state over the trolley, the maximum acceleration with which the trolley can be moved horizontally in m s^{-2} is :

($g = 10 \text{ m/s}^2$)

- (1) 1.5 (2) 1.8
(3) 2.1 (4) 1.2

36. The sum of kinetic energy and potential energy of a simple pendulum bob is 0.02 joule. The speed of the simple pendulum bob at equilibrium position is approximately :

(Consider mass of the bob = 20 g)

- (1) 1.41 m/s (2) 14.1 m/s
(3) 0.2 m/s (4) 2.0 m/s

37. Four statements are given (A is mass number) :

- A. The volume of a nucleus is proportional to $A^{1/3}$.
B. The volume of a nucleus is proportional to A.
C. The difference in mass of an atom and its nucleus is called the mass defect.
D. The difference in mass of a nucleus and its constituents is called the mass defect.

Choose the correct answer from the options given below :

- (1) B and D are true, but A and C are false
(2) A and D are true, but B and C are false
(3) A and C are true, but B and D are false
(4) B and C are true, but A and D are false

38. The angular speed of a flywheel is increased from 600 rpm to 1200 rpm in 10 s. The number of revolutions completed by the flywheel during this time is :

- (1) 600 (2) 900
(3) 300 (4) 150

39. A submarine is designed to withstand an absolute pressure of 100 atm. How deep can it go below the water surface ?

(Consider the density of water = 1000 kg m^{-3} ,

$1 \text{ atm} = 1 \times 10^5 \text{ Pa}$ and gravitational acceleration $g = 10 \text{ m/s}^2$)

- (1) 9900 m (2) 99 m
(3) 9000 m (4) 990 m

40. Match List I with List II :

List I (Electromagnetic wave)	List II (Production)
A. Microwave	I. Electrons in atoms emit light when they move from a higher energy level to a lower energy level
B. Visible light	II. Radioactive decay of nucleus
C. Gamma rays	III. Vibration of atoms and molecules
D. Infra-red rays	IV. Klystron valve or magnetron valve

Choose the **correct** answer from the options given below :

- (1) A-III, B-I, C-II, D-IV
 (2) A-III, B-IV, C-I, D-II
~~(3) A-IV, B-III, C-II, D-I~~
 (4) A-IV, B-I, C-II, D-III
41. Which of the following statements are correct ?
- A. Inside a conductor, the electrostatic field is zero.
 B. Electric field at the surface of a charged conductor does not depend on its surface charge density.
 C. The interior of a charged conductor can have no excess charge in the static situation.
 D. At the surface of a charged conductor, the electrostatic field must be normal to the surface at every point.
 E. The electrostatic potential is zero everywhere inside a charged conductor.
- Choose the **correct** answer from the options given below :
- (1) C, D and E only
 (2) A, B and D only
 (3) A, C and D only
 (4) A, C and E only

42. For a metal of work function 6.6 eV, which of the following wavelengths of incident radiation do **not** give rise to the photoelectric effect ?

(Take Planck's constant as 6.6×10^{-34} J s)

- (1) 200 nm (2) 150 nm
 (3) 100 nm (4) 50 nm

43. In the first excited state of hydrogen atom, the energy of its electron is -3.4 eV. The radius of the orbit of the electron from the hydrogen nucleus in this case is approximately :

(Take $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$, $e = 1.6 \times 10^{-19} \text{ C}$ and

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2)$$

- (1) $2.1 \times 10^{-8} \text{ m}$ (2) $2.1 \times 10^{-11} \text{ m}$
 (3) $2.1 \times 10^{-9} \text{ m}$ ~~(4) $2.1 \times 10^{-10} \text{ m}$~~

44. Two statements are given below :

- A. When the forward bias voltage across a p-n junction diode increases above a certain threshold voltage, the diode current increases significantly.
 B. This current is called reverse saturation current.

Choose the **correct** answer from the options given below :

- (1) Both Statements A and B are false
 (2) Statement A is true, but Statement B is false
 (3) Both Statements A and B are true
 (4) Statement A is false, but Statement B is true

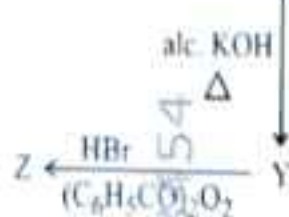
45. A flask contains argon and chlorine in the ratio 2 : 1 by mass. The temperature of the mixture is 27°C . The ratio of root mean square speed of

molecules of the two gases $\left(\frac{v_{\text{rms}}^{\text{Ar}}}{v_{\text{rms}}^{\text{Cl}}}\right)$ is :

(Atomic mass of argon = 40.0 u and molecular mass of chlorine = 70.0 u)

- (1) $\frac{\sqrt{7}}{2}$ (2) $\frac{7}{2}$
 (3) $\frac{7}{4}$ (4) $\frac{2}{\sqrt{7}}$

52. In the following reaction sequence, X and Z, respectively are :



- (1) $\text{X} = \text{POCl}_3$; $\text{Z} = \text{CH}_3 - \underset{\text{Br}}{\text{CH}} - \text{CH}_3$
- (2) $\text{X} = \text{H}_3\text{PO}_3$; $\text{Z} = \text{CH}_3\text{CH}_2\text{CH}_2 - \text{Br}$
- (3) $\text{X} = \text{H}_3\text{PO}_3$; $\text{Z} = \text{CH}_3 - \underset{\text{Br}}{\text{CH}} - \text{CH}_3$
- (4) $\text{X} = \text{POCl}_3$; $\text{Z} = \text{CH}_3\text{CH}_2\text{CH}_2 - \text{Br}$

53. Match List I with List II :

List I

(Transition metal/
compound/
complex)

A. V_2O_5

B. Fe

C. PdCl_2

D. Ni complex

List II

(Catalytic Role)

I. Preparation of
ammonia from
 N_2/H_2 mixture

II. Polymerisation of
alkynes

III. Preparation of
 H_2SO_4 from SO_2

IV. Oxidation of ethyne
to ethanal

Choose the correct answer from the options given below :

- (1) A-III, B-IV, C-I, D-II
- (2) A-II, B-I, C-IV, D-III
- (3) A-IV, B-I, C-III, D-II
- (4) A-III, B-I, C-IV, D-II

54. Identify the correct statement about ClF_3 from the following options :

- (1) It has a trigonal pyramidal geometry with two lone pairs on Cl atom.
- (2) It has T-shaped geometry with two lone pairs on Cl atom.
- (3) It has a planar trigonal geometry with two lone pairs on Cl atom.
- (4) It has T-shaped geometry with three lone pairs on Cl atom.

55. Calculate emf of the half cell given below :



$$E^\circ_{\text{H}_2/\text{H}^+} = 0 \text{ V}$$

$$\text{(Given: } \frac{2.303 RT}{F} = 0.059,$$

$$\log 2 = 0.3010)$$

- (1) 0.109 V
- (2) 0.035 V
- (3) -0.035 V
- (4) -0.109 V

56. Match List I with List II :

List I

(Order of reaction)

A. Zero order

B. First order

C. Second order

D. Third order

List II

(Unit of rate
constant)

mol⁻¹ L s⁻¹

mol⁻² L² s⁻¹

s⁻¹

mol L⁻¹ s⁻¹

Choose the correct answer from the options given below :

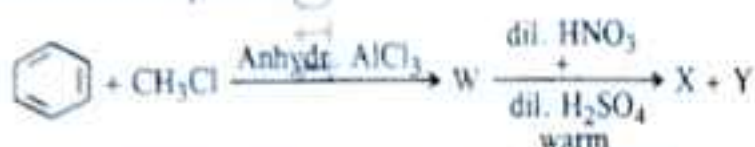
- (1) A-IV, B-III, C-II, D-I
- (2) A-I, B-II, C-III, D-IV
- (3) A-IV, B-III, C-I, D-II
- (4) A-IV, B-II, C-I, D-III

57. The calculated 'spin-only' magnetic moment of

$Ti^{2+}(3d^2)$ is :

- (1) 2.84 BM (2) 5.92 BM
(3) 4.90 BM (4) 3.87 BM

58. Two products X and Y are formed in the following reaction sequence.



The suitable method that can be used for the separation of products X and Y is :

- (1) Continuous extraction
(2) Differential extraction
(3) Fractional distillation
(4) Sublimation

59. A bulb is rated at 150 watt, converting 8% energy into light. If energy of one photon is 4.42×10^{-19} J, how many photons are emitted by the bulb per second ?

- (1) 1.35×10^{19} (2) 4.06×10^{19}
(3) 2.71×10^{19} (4) 27.2×10^{19}

60. In a test tube containing a salt, a few drops of dilute H_2SO_4 was added, which gave colourless vapours having the smell of vinegar. The vapours turned the blue litmus paper red.

Identify the **correct** anion from the following :

- (1) Acetate, CH_3COO^-
(2) Carbonate, CO_3^{2-}
(3) Sulphate, SO_4^{2-}
(4) Sulphide, S^{2-}

61. Select the reagents that reduce nitriles to primary amines :

- A. (i) LiAlH_4 ; (ii) H_2O
B. $\text{Sn} + \text{HCl}$
C. H_2/Ni
D. $\text{Na(Hg)}/\text{C}_2\text{H}_5\text{OH}$
E. $\text{Br}_2/\text{aq. NaOH}$

Choose the **correct** answer from the options given below :

- (1) A, B and C only
(2) A, C and D only
(3) A, D and E only
(4) B, D and E only

62. Identify the **incorrect** statement from the following :

- (1) Carbon has the ability to form $p\pi-p\pi$ multiple bond with itself.
(2) ECl_3 (E = B and Al) is a monomer when E = B and a dimer when E = Al.
(3) Oxygen exhibits only -2 oxidation state.
(4) The order of catenation property of Group 14 elements is $\text{C} \gg \text{Si} > \text{Ge} \approx \text{Sn}$.

63. Although +3 oxidation state is most common in lanthanoids, cerium still shows +4 oxidation state because :

- (1) Its nearest inert gas is Radon.
(2) After losing one more electron, it acquires $4f^{14}$ electronic configuration.
(3) Its atomic number is 61.
(4) After losing one more electron, it acquires $4f^0$ electronic configuration.

$$\frac{5.6}{60} \times 6.023 \times 10^{23}$$

$$\frac{5.6}{60} \times 6.023 \times 10^{23} \times Na = NaOH$$

64. During Lassaigne's test, the elements present in an organic compound are converted from :

- (1) covalent form to covalent form
- (2) ionic form to ionic form
- ~~(3) covalent form to ionic form~~
- (4) ionic form to covalent form

65. The number of hydrogen atoms present in 5.4 g of urea is :

(Given : Molar mass of urea : 60 g mol^{-1} ,

$N_A : 6.022 \times 10^{23} \text{ particles mol}^{-1}$)

- (1) 2.168×10^{23}
- (2) 2.168×10^{22}
- ~~(3) 1.084×10^{22}~~
- (4) 1.084×10^{23}

66. The pair of molecules that are metamers among the following is :

(1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_3$

~~(2) $\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$~~

(3) $\text{H}_3\text{C} - \text{C}(=\text{O}) - \text{CH}_3$ and $\text{H}_3\text{C} - \text{CH}_2 - \text{C}(=\text{O}) - \text{H}$

(4) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ and $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$

67. Identify the **incorrect** statement from the following :

- (1) $\text{P}(\text{C}_2\text{H}_5)_3$ and $\text{As}(\text{C}_6\text{H}_5)_3$ form $d\pi - d\pi$ bond with transition metals
- (2) Nitrogen can form $d\pi - p\pi$ bond with oxygen.
- (3) Nitrogen can form $p\pi - p\pi$ multiple bonds with itself.
- (4) Phosphorus, arsenic and antimony show catenation property.

68. Phenolphthalein is used as an indicator for the titration of sodium hydroxide solution against a standard solution of oxalic acid. The colour change that is observed at an alkaline pH close to the equivalence point during this titration is :

- ~~(1) pinkish red to yellow~~
- (2) yellow to pinkish red
- (3) colourless to pink
- (4) pink to colourless

69. Match List I with List II :

List I

List II

- | | |
|---------------------------|-------------------------------------|
| A. C_2H_4 | I. 3 σ bonds, 2 π bonds |
| B. C_2H_2 | II. 3 σ bonds, one lone pair |
| C. CH_4 | III. 4 σ bonds |
| D. NH_3 | IV. 5 σ bonds, 1 π bond |

Choose the **correct** answer from the options given below :

- ~~(1) A-IV, B-I, C-III, D-II~~
- (2) A-III, B-IV, C-II, D-I
- (3) A-I, B-II, C-IV, D-III
- (4) A-II, B-III, C-I, D-IV

70. At a certain temperature, T (K), during a process, 500 J is absorbed by the system and work of 200 J is done by the system. Then change in internal energy of the system is :

- (1) 700 J
- (2) 300 J
- (3) 400 J
- (4) 500 J

71. Methane reacts with steam at 1273 K in the presence of nickel catalyst to form :

- ~~(1) CO and H_2~~
- (2) CO and H_2O
- (3) CO_2 and H_2O
- (4) CO_2 and H_2

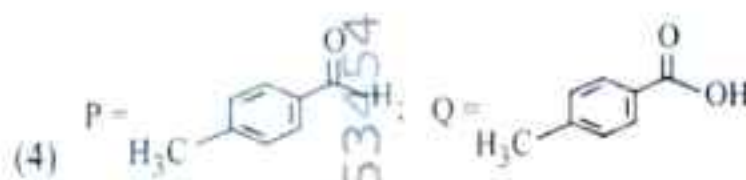
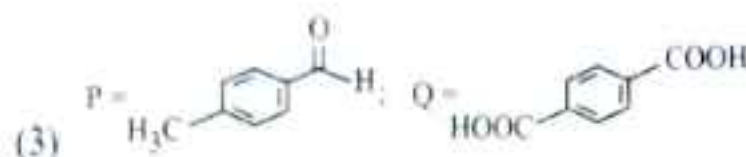
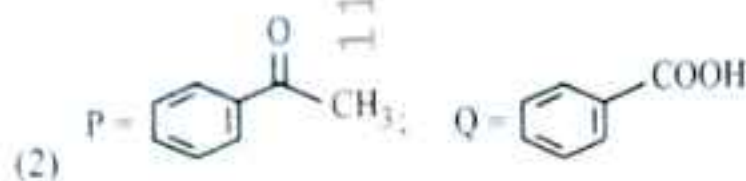
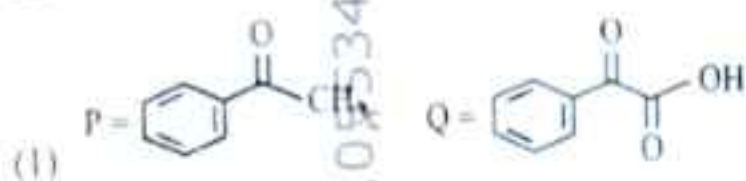
$$\Delta G = \Delta U + \Delta W$$

$$\Delta U = \Delta G + \Delta W$$

$$\Delta U = \Delta G - \Delta W$$

$$500 - 200$$

72. Compound P (C_8H_8O) gives a red orange precipitate with 2,4-DNP reagent and it does not reduce Fehling's reagent. On drastic oxidation with chromic acid, P gives an aromatic product Q that produces effervescence on treating with aq. $NaHCO_3$. Compounds P and Q, respectively, are :



73. A solution of copper sulphate is electrolysed for 10 minutes with a current of 1.5 amperes. The mass of copper deposited at cathode is :

(Given : Molar mass of Cu = 63 g mol^{-1} ;

$1 \text{ F} = 96487 \text{ C mol}^{-1}$)

- (1) 2.4036 g (2) 1.7018 g
(3) 0.5876 g (4) 0.2938 g

74. The functional group that can be identified through phthalein dye test is :

- (1) Phenolic
(2) Alcohol
(3) Aldehyde
(4) Carboxylic acid

75. The correct statement with regard to the secondary structure of DNA/RNA is :

- (1) DNA possesses a single strand helix structure and contains uracil as one of the four bases.
(2) RNA possesses a single strand helix structure and contains thymine as one of the four bases.
(3) DNA possesses a double strand helix structure and contains thymine as one of the four bases.
(4) RNA possesses a double strand helix structure and contains uracil as one of the four bases.

76. Identify the correct statements

- A. The molality of 2.5 g of ethanoic acid (Molar mass : 60 g mol^{-1}) in 75 g of benzene solution is 0.556 m.
B. The molarity of a solution containing 5 g of NaOH (molar mass : 40 g mol^{-1}) in 450 mL of solution is 0.278 M at 298 K.
C. Aquatic species are more comfortable in cold water.
D. The solubility of gas increases with decrease in pressure.
E. For a binary mixture of A and B, the number of moles of A and B are n_A and n_B respectively. The mole fraction of B will be $x_B = \frac{n_A}{n_A + n_B}$.

Choose the correct answer from the options given below :

- (1) A and C only
(2) A, B and C only
(3) A, D and E only
(4) A and B only

77. Mixture of chloroform and acetone forms a solution with negative deviation from Raoult's law due to :

- (1) formation of hydrogen bonding between acetone and chloroform.
- (2) increase in escaping tendency of molecules of each component.
- (3) stronger intermolecular forces between chloroform molecules than those between chloroform and acetone molecules.
- (4) repulsive forces.

78. At 298 K, a certain buffer solution contains equal concentrations of X^- and HX , K_b for X^- is 10^{-10} .

What is the pH of this buffer solution ?

- (1) 2
- (2) 10
- (3) 4
- (4) 6

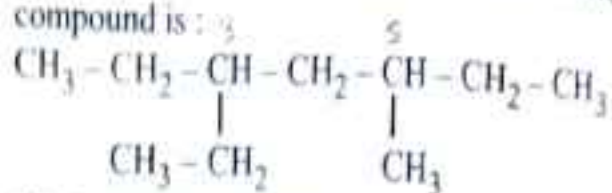
79. Identify the **incorrect** statement from the following :

- (1) The IUPAC name of the element with atomic number 107 is Unnilseptium.
- (2) The largest and the smallest species among Mg , Mg^{2+} , Al and Al^{3+} are Al and Mg^{2+} , respectively.
- (3) The similarity in behaviour of Li with Mg is referred to as 'diagonal relationship'.
- (4) The oxidation state and covalency of Al in $[AlCl(H_2O)_5]^{2+}$ are 3 and 6 respectively.

80. The correct order of increasing metallic character of Na, Be, P, Mg and Si is :

- (1) $P < Si < Be < Mg < Na$
- (2) $Be < Si < P < Mg < Na$
- (3) $P < Si < Na < Mg < Be$
- (4) $P < Mg < Be < Si < Na$

81. The correct IUPAC name of the following compound is :



- (1) 2,4-diethylhexane
- (2) 3,5-diethylhexane
- (3) 3-ethyl-5-methylheptane
- (4) 3-methyl-5-ethylheptane

82. Match List I with List II

List I

(Complex/ion)

List II

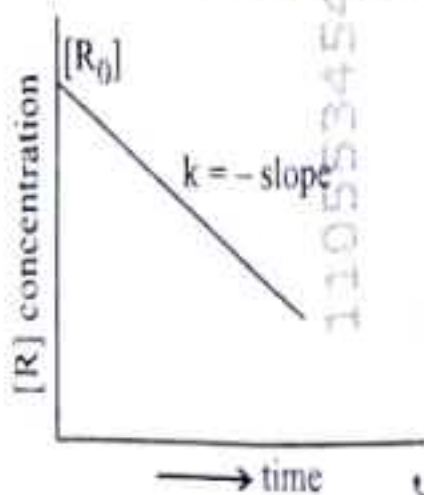
(Shape/geometry)

- | | |
|-------------------------|--------------------------|
| A. $[Pt(Cl_2)(NH_3)_2]$ | I. Octahedral |
| B. $[Co(NH_3)_6]Cl_3$ | II. Trigonal bipyramidal |
| C. $[NiCl_4]^{2-}$ | III. Square planar |
| D. $[Fe(CO)_5]$ | IV. Tetrahedral |

Choose the **correct** answer from the options given below :

- (1) A-I, B-III, C-IV, D-II
- (2) A-III, B-IV, C-I, D-II
- (3) A-IV, B-I, C-III, D-II
- (4) A-III, B-I, C-IV, D-II

83. For a certain reaction $R \rightarrow \text{Product}$, the plot of concentration $[R]$ vs time has a negative slope as shown. The order of reaction is :



- (1) 0
- (3) 2

$$k = \frac{R - R_0}{t}$$

$$y = mx + c$$

$$t =$$

- (2) 1
- (4) 2.5

84. Which one of the following is an ambidentate ligand?

- (1) Ethylenediaminetetraacetate ion
- (2) Oxalate
- (3) Ethane-1,2-diamine
- (4) Thiocyanate

85. Consider the following reaction:

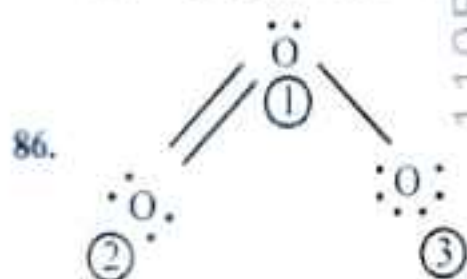


$\Delta U^\ominus = -10 \text{ kJ mol}^{-1}$ and $\Delta S^\ominus = -44 \text{ J K}^{-1}$ at 298 K.

Identify the correct option with $\Delta G^\ominus$ for the reaction and spontaneity of the reaction at 298 K.

(Given: $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$)

- (1) $-1.635 \text{ kJ mol}^{-1}$, spontaneous
- (2) $+0.63568 \text{ kJ mol}^{-1}$, non-spontaneous
- (3) $-0.63568 \text{ kJ mol}^{-1}$, spontaneous
- (4) $+1.635 \text{ kJ mol}^{-1}$, non-spontaneous



The correct formal charges on oxygen atoms numbered 2, 1 and 3 respectively are:

- (1) $-1, 0, +1$
- (2) $0, +1, -1$
- (3) $0, 0, 0$
- (4) $+1, 0, -1$

87. Given below are certain reactions. Identify the reaction for which $K_p \neq K_c$.

- (1) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
- (2) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
- (3) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
- (4) $H_2O(g) + CO(g) \rightleftharpoons H_2(g) + CO_2(g)$

88. Given below is an expression for the rate constant of a first order reaction occurring at a certain temperature, T (K).

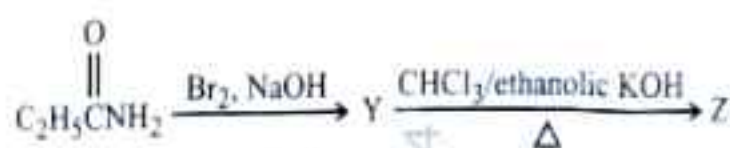
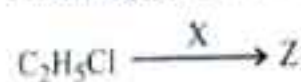
$$\ln k = 14.34 - \frac{1.25 \times 10^4}{T}$$

The energy of activation in kcal mol^{-1} for the reaction is:

(Given: k in s^{-1} , $R = 1.987 \text{ cal mol}^{-1} \text{ K}^{-1}$)

- (1) 12.42
- (2) 14.34
- (3) 18.63
- (4) 24.84

89. The following two reactions give the same foul smelling product Z.



X and Z, respectively, are

- (1) $X = AgCN$; $Z = C_2H_5CN$
- (2) $X = KCN$; $Z = C_2H_5CN$
- (3) $X = KCN$; $Z = C_2H_5NC$
- (4) $X = AgCN$; $Z = C_2H_5NC$

90. Match List I with List II:

List I (Complex)	List II (Type of isomerism)
A. $[Pt(NH_3)_2Cl_2]$	I. Optical
B. $[Co(en)_3]^{3+}$	II. Solvate
C. $[Co(NH_3)_5NO_2]Cl_2$	III. Geometrical
D. $[Cr(H_2O)_6]Cl_3$	IV. Linkage

Choose the correct answer from the options given below:

- (1) A-III, B-I, C-II, D-IV
- (2) A-I, B-III, C-II, D-IV
- (3) A-III, B-I, C-IV, D-II
- (4) A-II, B-IV, C-III, D-I

