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JEE-Main

3rd Revision Minor Test

JEE-Mains Type Test paper

Test Date: 29 Dec, 2024 **M.M:300**

TEST INSTRUCTIONS

1. The test is of **3 hours** duration.
2. The test booklet consists of **75 questions**.
3. The maximum marks are **300**.
4. All questions are compulsory.
5. There are three parts in the questions paper consisting of Physics, Chemistry and Mathematics having **25 questions in each part**.

Each Parts Contains –

- 20 multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct. All questions are carrying **+4 marks** for right answer and **–1 mark** for wrong answer.
- 05 questions with answer as **numerical value** all questions are carrying **+4 marks** for right answer and **–1 marks** for wrong answers.

Syllabus: Physics-Current Electricity, Optics Magnetic effects of current and magnetism, Electromagnetic waves, Dual nature of matter and radiation atoms and Nuclei, Electronic Devices | Chemistry-Redox reactions and electrochemistry, Chemical kinetics, Classification of elements and periodicity in properties, Purification and Characterization of Organic Compounds, Some Basic Principles of Organic Chemistry, Hydrocarbons | Math-Matrices and Determinants, Permutations and Combinations, Binomial Theorem and its simple applications, Co-ordinate geometry

Name of the Candidate (in Capital Letter): _____

Registration No. _____

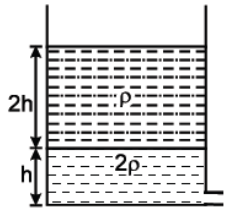
Invigilator Signature

Physics

(Single Correct Choice Type)

This Section contains **20 multiple choice questions.** Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

1. The velocity of the liquid coming out of a small hole of a large vessel containing two different liquids of densities 2ρ and ρ as shown in figure is

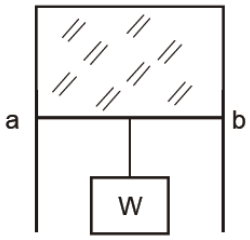


(a) $\sqrt{6gh}$ (b) $2\sqrt{gh}$ (c) $2\sqrt{2gh}$ (d) $\sqrt{gh}$

2. A small ball of density ρ is immersed in a liquid of density $\sigma(>\rho)$ to a depth h and released. The height above surface of water upto which the ball will jump is -

(a) $\left(\frac{6}{\rho}-1\right)h$ (b) $\left(\frac{\rho}{6}-1\right)h$ (c) $\left(\frac{\rho}{6}+1\right)h$ (d) $\left(\frac{6}{\rho}+1\right)h$

3. A film of soap solution is trapped between a vertical frame and a light wire ab of length 0.1 m. If $g=10\,m/s^2$, then the load W that should be suspended from the wire to keep it in equilibrium is : [S.T. of film is $25\times10^{-3}N/m$]



(a) 0.2 g (b) 0.3 g (c) 0.4 g (d) 0.05 g

4. Two rods of different materials having coefficients of linear expansion α_1 and α_2 and Young's moduli, Y_1 and Y_2 respectively are fixed between two rigid massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of rods. If $\frac{\alpha_1}{\alpha_2}=\frac{2}{3}$, then the thermal stress developed in the two rods are equal, provided $\frac{Y_1}{Y_2}$ is equal to :

(a) 2 : 3 (b) 1 : 1 (c) 3 : 2 (d) 4 : 9

5. Two point sources P and Q are 24 cm apart. Where should a convex lens of focal length 9 cm be placed in between them so that the images of both sources are formed at the same place?

(a) 3 cm from P (b) 15 cm from Q (c) 9 cm from Q (d) 18 cm from P

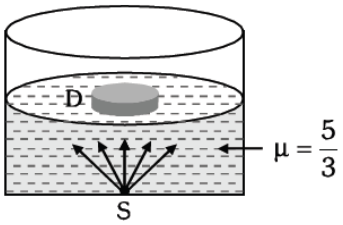
6. A beaker containing liquid is placed on a table, underneath a microscope which can be moved along a vertical scale. The microscope is focussed, through the liquid onto a mark on the table when the reading on the scale is a. It is next focussed on the upper surface of the liquid and the reading is b. More liquid is added and the observations are repeated, the corresponding readings are c and d. The refractive index of the liquid is

(a) $\frac{d-b}{d-c-b+a}$ (b) $\frac{b-d}{d-c-b+a}$ (c) $\frac{d-c-b+a}{d-b}$ (d) $\frac{d-b}{a+b-c-d}$

7. The focal length of objective and eye lens of a microscope are 4 cm and 8 cm respectively. If the least distance of distinct vision is 24 cm and object distance is 4.5 cm from the objective lens, then the magnifying power of the microscope will be :

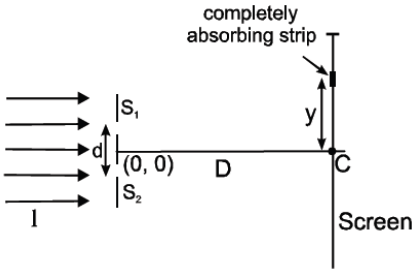
(a) 18 (b) 32 (c) 64 (d) 20

8. A point source of light S is placed at the bottom of a vessel containing a liquid of refractive index 5/3. A person is viewing the source from above the surface. There is an opaque disc D of radius 1 cm floating on the surface of the liquid. The centre of the disc lies vertically above the source S. The liquid from the vessel is gradually drained out through a tap. The maximum height of the liquid for which the source cannot be seen at all from above is



(a) 1.50 cm (b) 1.64 cm (c) 1.33 cm (d) 1.86 cm

9. Figure shows two, identical narrow slits S_1 and S_2. A very small completely absorbing strip is placed at distance 'y' from the point C. 'C' is the point on the screen equidistant from S_1 and S_2. Assume $\lambda << d << D$ where λ, d and D have usual meaning. When S_2 is covered the force due to light acting on strip is 'f' and when both slits are opened the force acting on strip is 2f. Find the minimum positive 'y' (<<D) coordinate of the strip in terms of λ, d and D.



(a) $\frac{\lambda D}{4d}$ (b) $\frac{\lambda D}{2d}$ (c) $\frac{\lambda D}{d}$ (d) None of these

10. The wavefront of a light beams is given by the equation $x+2y+3z=c$, (where c is arbitrary constant) then the angle made by the direction of light with the y-axis is :

(a) $\cos^{-1}\frac{1}{\sqrt{14}}$ (b) $\sin^{-1}\frac{2}{\sqrt{14}}$ (c) $\cos^{-1}\frac{2}{\sqrt{14}}$ (d) $\sin^{-1}\frac{3}{\sqrt{14}}$

11. An α-particle of 5 MeV energy strikes with a nucleus of uranium at stationary at an scattering angle of 180^{o}. The nearest distance upto which α-particle reaches the nucleus will be of the order of

(a) 1 Å (b) 10^{-10}cm (c) 10^{-12}cm (d) 10^{-15}cm

12. The photon radiated from hydrogen corresponding to 2nd line of Lyman series is absorbed by a hydrogen like atom 'X' in 2nd excited state. As a result the hydrogen like atom 'X' makes a transition to nth orbit. Then,

(a) $X=He^{+}, n=4$ (b) $X=Li^{++}, n=6$ (c) $X=He^{+}, n=6$ (d) $X=Li^{++}, n=9$

13. An α-particle with a kinetic energy of 2.1 eV makes a head on collision with a hydrogen atom moving towards it with a kinetic energy of 8.4 eV. The collision.

(a) must be perfectly elastic (b) may be perfectly inelastic
(c) may be inelastic (d) must be perfectly inelastic

14. The voltage applied to an X-ray tube is 18 kV. The maximum mass of photon emitted by the X-ray tube will be :

(a) 2×10^{-13}kg (b) 3.2×10^{-36}kg (c) 3.2×10^{-32}kg (d) 9.1×10^{-31}kg

15. In a Coolidge tube, the tungsten (Z = 74) target is bombarded by electrons. What is the minimum value of the accelerating potential to enable emission of characteristic k_{α} and k_{β} lines of tungsten. (The K, L & M levels of tungsten have Binding energies of 69.5, 11.3 & 2.30 keV respectively).

(a) 38.5 kV (b) 49.5 kV (c) 19.28 kV (d) 69.5 kV

16. Masses of two isobars $_{29}Cu^{64}$ and $_{30}Zn^{64}$ are 63.9298 u and 63.9292u respectively. It can be concluded from these data that

(a) Both the isobars are stable

(b) Zn^{64} is radioactive, decaying to Cu^{64} through β-decay

(c) Cu^{64} is radioactive, decaying to Zn^{64} through γ-decay

(d) Cu^{64} is radioactive, decaying to Zn^{64} through β-decay

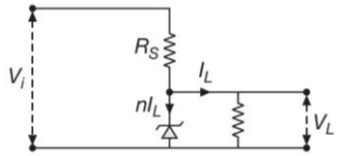
17. A stationary Pb^{200} nucleus emits and alpha particle with kinetic energy Tα. The fraction of recoil energy of the daughter nucleus to the total energy liberated is

(a) $\frac{1}{196}$ (b) $\frac{1}{20}$ (c) $\frac{4}{196}$ (d) $\frac{1}{50}$

18. A radioactive nucleus emits an α-particle and a neutron simultaneously with same speed but in opposite direction in order to form a stable nuclei if the speed of emitted particles is v and A is the mass number of radioactive nucleus, then speed of stable nucleus is

(a) $\frac{3v}{A-5}$ (b) $\frac{2v}{A-5}$ (c) $\frac{4v}{A-5}$ (d) $\frac{2v}{A+5}$

19. The value of the resistor, R_S, needed in the dc voltage regulator circuit shown here, equals



(a) $\frac{(V_i - V_L)}{nI_L}$ (b) $\frac{(V_i + V_L)}{nI_L}$ (c) $\frac{(V_i - V_L)}{(n+1)I_L}$ (d) $\frac{(V_i + V_L)}{(n+1)I_L}$

20. The average value of electric energy density in in an electromagnetic wave is (E_0 is peak value)

(a) $\frac{1}{2}\varepsilon_0 E_0^2$ (b) $\frac{E_0^2}{2\varepsilon_0}$ (c) $\varepsilon_0 E_0^2$ (d) $\frac{1}{4}\varepsilon_0 E_0^2$

(Integer Type Questions)

This Section contains **5 Questions.** The answer to each question is a single digit integer ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. ^{23}Ne decays to ^{23}Na by negative beta emission. Mass of ^{23}Ne is 22.994465 amu mass of ^{23}Na is 22.989768 amu. Calculate the maximum kinetic energy of emitted electrons in MeV, neglecting the kinetic energy of recoiling product nucleus

2. Hydrogen gas in the atomic state is excited to an energy level such that the electrostatic potential energy of hydrogen atom becomes -1.7 eV. Now a photoelectric plate having work function 2.3 eV is exposed to the emission spectra of this gas. Assuming all the transitions to be possible, find the minimum de-Broglie wavelength of the ejected photoelectrons is Å to the nearest integer.

3. The human eye can barely detect a yellow light (6000 Å) that delivers 1.7×10^{-8} W to the retina. How many photons strike the retina in one second is $\alpha\times10^{\beta}$, where α is measures to the nearest integer and β is the integer. Calculate $\frac{\beta}{\alpha}$.

4. Gravitational acceleration on the surface of a planet is $\frac{\sqrt{12}}{11}g$, where g is the gravitational acceleration on the surface of the earth. The average mass density of the planet is $\frac{4}{3}$ times that of the earth. If the escape speed on the surface of the earth is taken to be 11 kms^{-1}, find the escape speed on the surface of the planet in kms^{-1}.

5. An object is placed 12 cm to the left of a diverging lens of focal length -6 cm. A converging lens with a focal length of 12 cm is placed at a distance d to the right of the diverging lens. Find the distance d, in cm, that corresponds to a final image at infinity.

Chemistry

(Single Correct Choice Type)

This Section contains **20 multiple choice questions.** Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

1. Which of the following is correct?

   (a) Molecularity of a reaction can be fractional

   (b) Zero order reaction never stops

   (c) A first order reaction must be homogeneous

   (d) The frequency factor 'A' in Arrhenius equation ($k = Ae^{-E_a/RT}$) increase with increase in temperature

2. A reactant (A) forms two products:

   $A \xrightarrow{k_1} B$ Activation energy E_{a_1}

   $A \xrightarrow{k_2} C$ Activation energy E_{a_2}

   If $E_{a_2} = 2E_{a_1}$, then k_1 and k_2 will be related as:

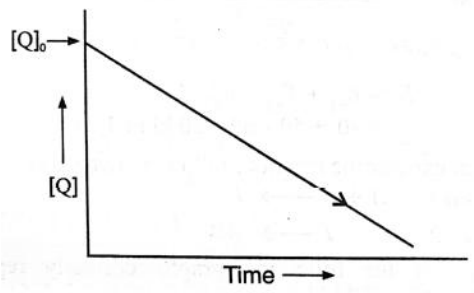
   (a) $k_2 = k_1 e^{E_{a1}/RT}$ (b) $k_2 = k_1 e^{E_{a2}/RT}$

   (c) $k_1 = k_2 e^{E_{a1}/RT}$ (d) $k_1 = 2k_2 e^{E_{a2}/RT}$

3. In the reaction,

   $P + Q \longrightarrow R + S$

   The time taken for 75% reaction of P is twice the time taken for 50% reaction of P. The concentration of Q varies with reaction time as shown in the figure. The overall order of the reaction is:



   (a) 2 (b) 3 (c) 0 (d) 1

4. Which of the following oxides cannot work as a reducing agent?

(a) CO_2 (b) NO_2 (c) SO_2 (d) ClO_2

5. On electrolysis, which of the following does not give out oxygen?

(a) Acidic water using Pt electrode (b) Fused NaOH using Pt electrode

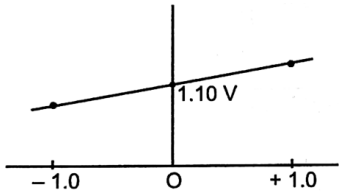
(c) Dilute H_2SO_4 using Pt electrode (d) Dilute H_2SO_4 using Cu electrode

6. For the redox process,

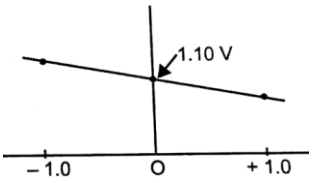
$$Zn(s) + Cu^{2+} \rightleftharpoons Zn^{2+} + Cu(s) \quad E^o_{cell} = +1.10V$$

which graph correctly represents E_{cell} (Y-axis) as a function of $\log \frac{[Zn^{2+}]}{[Cu^{2+}]}$ (X-axis)?

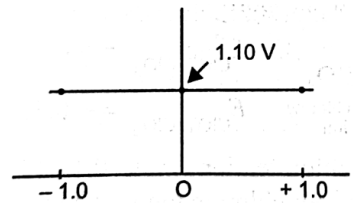
(a)



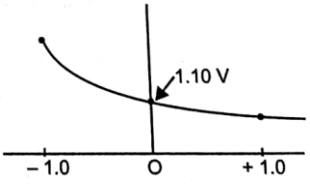
(b)



(c)



(d)



7. Which of the following statements is/in correct?

(a) One faraday is the charge carried by one mole of electrons

(b) If same quantity of electricity flows through the solutions of 0.1 M $AgNO_3$ and 0.1 M $CuSO_4$ solution, same weight of silver and copper will be deposited

(c) Electrochemical equivalent has the units of grams per coulomb

(d) Passage of one faraday of electricity produces one gram equivalent of the substance at the electrode

8. In the following process of disproportionation:

$$\underset{\text{Chlorate ion}}{2ClO_3^-} \rightleftharpoons ClO_2^- + \underset{\text{Per chlorate ion}}{ClO_4^-}$$

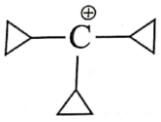
$$E^\circ_{ClO_4^-/ClO_3^-} = +0.36 \text{ V}$$

$$E^\circ_{ClO_3^-/ClO_2^-} = +0.33 \text{ V}$$

Initial concentration of chlorate ion was 0.1 M. The equilibrium concentration per chlorate ion will be:

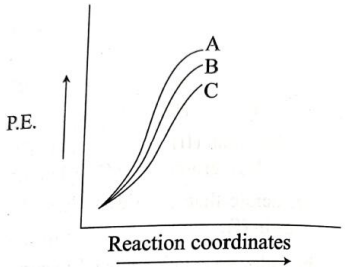
(a) 0.19 V (b) 0.1 M (c) 0.024 M (d) 0.019 M

9. In the following graph, stability of different carbocations have been shown:

(I) 

(II) 

(III) Ph – $\overset{\oplus}{C}$ – Ph
|
Ph



Match the potential energy curve with carbocation.

	I	II	III		I	II	III
(a)	A	B	C	(b)	B	A	C
(c)	C	B	A	(d)	C	A	B

10. The decreasing order of –I effect of the following is:

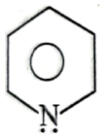
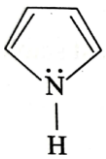
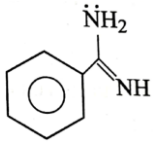
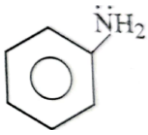
I. $R_3N^{\oplus}$ II. NO_2 III. CN

IV. SO_3H V. COOH

(a) I > II > III > IV > V (b) II > I > III > IV > V

(c) I > II > III > V > IV (d) II > I > V > IV > III

11. The decreasing order of basic character of the following is:

(I)  (II)  (III)  (IV) 

(a) III > I > IV > II (b) II > I > IV > III (c) IV > III > II > I (d) I > II > III > IV

12. **Assertion (A):** The pK_a value of  (I) is lower than the pK_a value of  (II).

Reason (R): Nonaromatic compounds are more stable than anti-aromatic compounds.

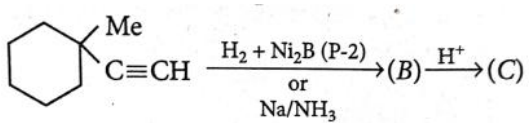
(a) If both (A) and (R) are true and (R) is the correct explanation of (A).

(b) If both (A) and (R) are true but (R) is not the correct explanation of (A)

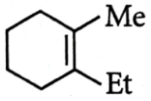
(c) If (A) is true but (R) is false

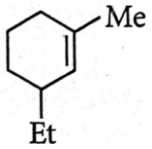
(d) If (A) is false but (R) if true

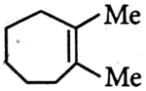
13. Observe the given sequence of reactions:

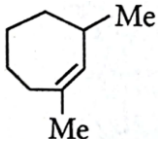


The compound (C) is

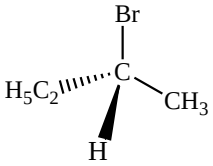
(a) 

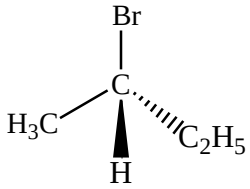
(b) 

(c) 

(d) 

14. Addition of HBr to 1-butene gives a mixture of products A, B and C.

(A) 

(B) 

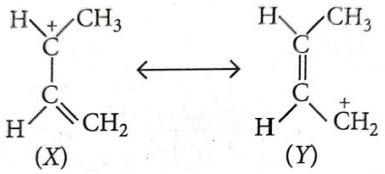
(C) $CH_3CH_2CH_2CH_2-Br$

The mixture consists of

(a) A and B as major and C as minor product
(b) B as major, A and C as minor products
(c) B as minor, A and C as major products
(d) A and B as minor and C as major product

15. Consider the addition of HBr to 1, 3-butadiene:

I. Markownikoff addition occurs, producing the allylic carbocation.



II. 3-bromo-1-butene from (X) is the kinetic product.

III. cis-1-bromo-2-butene from (Y) is the thermodynamic product.

Select the correct statements.

(a) Only I and II
(b) Only II and III
(c) Only I and III
(d) I, II and III

16. If each orbital can take maximum of three electrons, the number of elements in the third period of the periodic table will be:

(a) 12
(b) 6
(c) 8
(d) 24

17. In which of the following options order of arrangement does not agree with the variation of property indicated against it?

(i) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$ (increasing ionic radii)

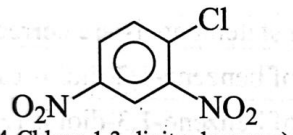
(ii) B < C < N < O (increasing first ionisation enthalpy)

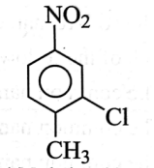
(iii) I < Br < Cl < F (increasing electron gain enthalpy)

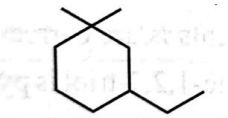
(iv) Li < Na < K < Rb (increasing metallic radius)

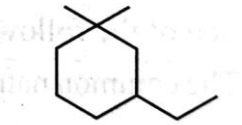
(a) i & iv
(b) ii & iii
(c) iii & iv
(d) i, ii, iii

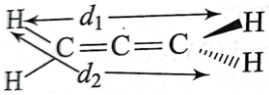
18. Which of the following is correctly named?

(a) 
(4-Chloro-1,3-dinitro benzene)

(b) 
4-Methyl-5-chloro-nitro benzene

(c) 
3-Ethyl-1,1-dimethyl cyclo hexane

(d) 
1-Ethyl-3,3-dimethyl cyclohexane

19. 

Choose the correct relation between d_1 and d_2 ?

(a) $d_1 = d_2$ (b) $d_1 > d_2$ (c) $d_1 < d_2$ (d) $d_2 = 2d_1$

20. The compound which is not isomeric with diethyl ether is

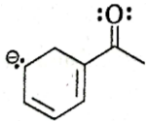
(a) n-Propyl methyl ether (b) Butanol

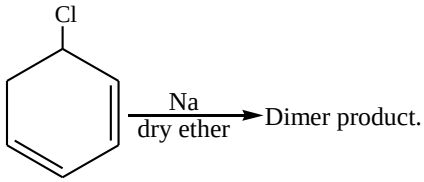
(c) 2-Methyl propan-2-ol (d) Butanone

(Integer Type Questions)

This Section contains 5 **Questions.** The answer to each question is a single digit integer ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

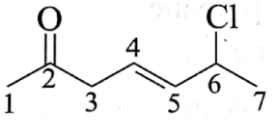
1. If the $t_{1/2}$ for a first order reaction is 0.4 min, the time of or 99.9% completion of the reaction is ..... min.
2. The value of n in the molecular formula $Be_nAl_2Si_6O_{18}$ is :
3. How many total resonance structures can be drawn for the following anion (include those without separation of charges)?



4. 

The number of dimer product are:

5. Total number of stereoisomers for the following compounds are:



Mathematics

(Single Correct Choice Type)

This Section contains **20 multiple choice questions.** Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

1. If the third term is the binomial expansion of $(1+x^{\log_2 x})^5$ equals 2560, then a possible value of x is :

   (a) $2\sqrt{2}$ (b) $\frac{1}{8}$ (c) $4\sqrt{2}$ (d) $\frac{1}{4}$

2. Let $x=\left(8\sqrt{3}+13\right)^{13}$ and $y=(7\sqrt{2}+9)^9$. If [t] denotes the greatest integer $\le t$, then

   (a) $[x]+[y]$ is even (b) [x] is odd but [y] is even

   (c) [x] and [y] are both odd (d) [x] is even but [y] is odd

3. Out of 11 consecutive natural number if three numbers are selected at random (without repetition), then the probability that they are in A.P. with positive common difference is :

   (a) $\frac{10}{99}$ (b) $\frac{15}{101}$ (c) $\frac{5}{33}$ (d) $\frac{5}{101}$

4. If $\cos(\alpha+\beta)=\frac{3}{5}, \sin(\alpha-\beta)=\frac{5}{13}$ and $0<\alpha,\beta<\frac{\pi}{4}$, then $\tan(2\alpha)$ is equal to:

   (a) $\frac{63}{52}$ (b) $\frac{33}{52}$ (c) $\frac{63}{16}$ (d) $\frac{21}{16}$

5. The distance of the point (1, 0, 2) from the point of intersection of the line $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-2}{12}$ and the plane $x-y+z=16$, is :

   (a) $3\sqrt{21}$ (b) 13 (c) $2\sqrt{14}$ (d) 8

6. Let α be the angle between the lines whose direction cosines satisfy the equations $\ell+m-n=0$ and $\ell^2+m^2-n^2=0$. Then the value of $\sin^4\alpha+\cos^4\alpha$ is :

   (a) $\frac{5}{8}$ (b) $\frac{3}{8}$ (c) $\frac{1}{2}$ (d) $\frac{3}{4}$

7. Let $\vec{a}=2\hat{i}+\hat{j}-2\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}$. Let $\vec{C}$ be a vector such that $|\vec{c}-\vec{a}|=3$, $\left|\left(\vec{a}\times\vec{b}\right)\times\vec{c}\right|=3$ and the angle between $\vec{c}$ and $\vec{a}\times\vec{b}$ be 30^0. Then $\vec{a}.\vec{c}$ is equal to :

   (a) 2 (b) 5 (c) $\frac{1}{8}$ (d) $\frac{25}{8}$

8. A tangent to the curve , $y=f(x)$ at $P(x,y)$ meets x –axis at A and $y-axis$ AP : BP = 1: 3 and $f(1)=1$, then the curve also passes through the point :

   (1) $\left(\frac{1}{3},24\right)$ (b) $\left(\frac{1}{2},4\right)$ (c) $\left(2,\frac{1}{8}\right)$ (d) $\left(3,\frac{1}{28}\right)$

9. Let $f:(0,\infty)\to(0,\infty)$ be a differentiable function such that f(1) = e and $\lim\limits_{t\to x}\frac{t^2f^2(x)-x^2f^2(t)}{t-x}=0$. If $f(x)=1$, then x is equal to :

   (a) $\frac{1}{e}$ (b) 2e (c) $\frac{1}{2e}$ (d) e

10. The sum of the real values of x for which the middle term in the binomial expansion of $\left(\frac{x^3}{3}+\frac{3}{x}\right)^8$ equals 5670 is ;

(a) 6 (b) 8 (c) 0 (d) 4

11. Box I contains 30 cards numbered I to 30 and Box II contains 20 cards numbered 31 to 50. A box is selected at random and a card is drawn from it . The number on the card is found to be a non-prime number. The probability that hte car was drawn from Box I is :

(a) $\frac{2}{3}$ (b) $\frac{2}{5}$ (c) $\frac{8}{17}$ (d) $\frac{4}{17}$

12. Let M and m respectively be the maximum and minimum values of the function $f(x)=\tan^{-1}(\sin x+\cos x)$ in $\left[0,\frac{\pi}{2}\right]$, Then the value of $\tan(M-m)$ is equal to :

(a) $2+\sqrt{3}$ (b) $2-\sqrt{3}$ (c) $2-\sqrt{3}$ (d) $3-2\sqrt{2}$

13. If the fourth term in the expansion of $(x+x^{\log_2 x})^7$ is 4480, then the value of x where $x\in N$ is equal to :

(a) 2 (b) 4 (c) 3 (d) 1

14. Let E and F be two independent events. The probability that both E and F happen is $\frac{1}{12}$ and the probability that neither E nor F happens is $\frac{1}{2}$, then a value of $\frac{P(E)}{P(F)}$ is :

(a) $\frac{4}{3}$ (b) $\frac{3}{2}$ (c) $\frac{1}{3}$ (d) $\frac{5}{12}$

15. If S is the sum of the first 10 terms of the series $\tan^{-1}\left(\frac{1}{3}\right)+\tan^{-1}\left(\frac{1}{7}\right)+\tan^{-1}\left(\frac{1}{13}\right)+\tan^{-1}\left(\frac{1}{21}\right)+.....$, then $\tan(S)$ is equal to :

(a) $-\frac{6}{5}$ (b) $\frac{5}{11}$ (c) $\frac{5}{6}$ (d) $\frac{10}{11}$

16. The value of $2\sin\left(\frac{\pi}{8}\right)\sin\left(\frac{2\pi}{8}\right)\sin\left(\frac{3\pi}{8}\right)\sin\left(\frac{5\pi}{8}\right)\sin\left(\frac{6\pi}{8}\right)\sin\left(\frac{7\pi}{8}\right)$ is :

(a) $\frac{1}{4\sqrt{2}}$ (b) $\frac{1}{4}$ (c) $\frac{1}{8}$ (d) $\frac{1}{8\sqrt{2}}$

17. If an angle between the line , $\frac{x+1}{2}=\frac{y-2}{1}=\frac{z-3}{-2}$ and the plane, $x-2y-kz=3$ is $\cos^{-1}\left(\frac{2\sqrt{2}}{3}\right)$, then a value of k is :

(a) $-\frac{5}{3}$ (b) $\sqrt{\frac{3}{5}}$ (c) $\sqrt{\frac{5}{3}}$ (d) $-\frac{3}{5}$

18. Let $\vec{a}=\hat{i}+\hat{j}+2\hat{k}$ and $\vec{b}=-\hat{i}+2\hat{j}+3\hat{k}$. Then the vector product $(\vec{a}+\vec{b})\times\left((\vec{a}\times((\vec{a}-\vec{b})\times\vec{b}))\times\vec{b}\right)$ is equal to

(a) $7(30\hat{i}-5\hat{j}+7\hat{k})$ (b) $5(34\hat{i}-5\hat{j}+3\hat{k})$ (c) $5(30\hat{i}-5\hat{j}+7\hat{k})$ (d) $7(34\hat{i}-5\hat{j}+3\hat{k})$

19. If $\frac{dy}{dx}+\frac{3}{\cos^2 x}y=\frac{1}{\cos^2 x}, x\in\left(\frac{-\pi}{3},\frac{\pi}{3}\right)$, and $y\left(\frac{\pi}{4}\right)=\frac{4}{3}$, then $y\left(-\frac{\pi}{4}\right)$ equals :

(a) $\frac{1}{3}+e^6$ (b) $\frac{1}{3}$ (c) $-\frac{4}{3}$ (d) $\frac{1}{3}+e^3$

20. If the solution curve of the differential equation $\frac{dy}{dx}=\frac{x+y-2}{x-y}$ passes through the point (2,1) and $(k+1,2)\,k>0$, then

(a) $2\tan^{-1}\left(\frac{1}{k}\right)=\log_e\left(k^2+1\right)$ (b) $\tan^{-1}\left(\frac{1}{k}\right)=\log_e\left(k^2+1\right)$

(c) $2\tan^{-1}\left(\frac{1}{k+1}\right)=\log_e(k^2+2k+2)$ (d) $2\tan^{-1}\left(\frac{1}{k}\right)=\log_e\left(\frac{k^2+1}{k^2}\right)$

(Integer Type Questions)

This Section contains **5 Questions.** The answer to each question is a single digit integer ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. The coefficient of x^4 in the expansion of $(1+x+x^2+x^3)^6$ in powers of x, is .....
2. The number of solutions of the equations $|\cot x|=\cot x+\frac{1}{\sin x}$ in the interval [0 , 2π] is
3. The probability of a man hitting a target is $\frac{1}{10}$. The least number of shots required, so that the probability of his hitting the target at least once is greater than $\frac{1}{4}$, is .....
4. If the equation of a plane P , passing through the intersection of the planes , $x+4y-z+7=0$ and $3x+y+5z=83$ is $ax+by+6z=15$ for some a, $b\in R$, then the distance of the point (3, 2,-1) from the plane P is ..... .
5. Let the vectors $\vec{a},\vec{b},\vec{c}$ be such that $|\vec{a}|=2,|\vec{b}|=4$ and $|\vec{c}|=4$. If the projection of $\vec{b}$ on $\vec{a}$ is equal to the projection of $\vec{c}$ on $\vec{a}$ and $\vec{b}$ is perpendicular to $\vec{c}$, then the value of $|\vec{a}+\vec{b}-\vec{c}|$ is ..

Date- 29-12-2024 **Answer – key**

3rd Revision Minor JEE-Main Test (Main Type)

Physics

1. b
2. a
3. d
4. c
5. d
6. a
7. b
8. c
9. a
10. c
11. c
12. d
13. c
14. c
15. d
16. d
17. d
18. a
19. c
20. d

Integer

1. 4
2. 4
3. 2
4. 3
5. 8

Chemistry

1. d
2. c
3. d
4. a
5. d
6. b
7. b
8. d
9. c
10. a
11. a
12. a
13. c
14. a
15. d
16. a
17. b
18. c
19. a
20. d

Integer

1. 4
2. 3
3. 4
4. 3
5. 4

Maths

1. d
2. a
3. c
4. c
5. b
6. a
7. a
8. c
9. a
10. c
11. c
12. d
13. a
14. a
15. c
16. c
17. c
18. d
19. a
20. a

Integer

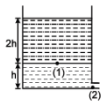
1. 49
2. 1
3. 3
4. 3
5. 6

3rd Revision Minor JEE-Main Test (Main Type)

PHYSICS

1. (b)

Pressure at (1) :
$P_1 = P_{atm} + \rho g\,(2h)$
Applying Bernoulli's theorum between points (1) and (2)



$$[P_{atm} + 2\rho g h] + \rho g(2h) + \frac{1}{2}(2\rho)(0)^2$$

$$= P_{atm} + (2\rho)\,g\,(0) + \frac{1}{2}(2\rho)v^2$$

$\Rightarrow \quad v = 2\sqrt{gh}$ **Ans.**

2. (a)

Let v be the volume of the ball
Net upward force = $v\sigma g - v\rho g$

Net upward acceleration $a = \dfrac{v\sigma g - v\rho g}{v\rho} = \dfrac{(\sigma-\rho)g}{\rho}$

Velocity at the surface $= \sqrt{\dfrac{2(\sigma-\rho)gh}{\rho}}$

if ha is the height in air to whieh the ball is oises then

$$0 - \frac{2(\sigma-\rho)gh}{g\rho} = 2(-g)ha$$

$$ha = \frac{(\sigma-\rho)gh}{g\rho} \Rightarrow ha = \left(\frac{6}{\rho} - 1\right)h$$

3. (d)

$$25 \times 10^{-3} \times 2 \times 0.1 = m \times 10$$

or $\quad m = \dfrac{5\times10^{-3}}{10}\,kg = 0.5\,g$

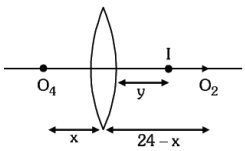
4. (c)

Thermal stress = $Y\alpha t$ in the given problem
$Y\alpha$ = constant

$$\frac{Y_1}{Y_2} = \frac{\alpha_3}{\alpha_1} = \frac{3}{2}$$

5. (d)

Let the image distance from lens by y



$$\frac{1}{y} - \frac{1}{-(24-x)} = \frac{1}{9}$$

$$\frac{1}{-y} - \frac{1}{-x} = \frac{1}{9}$$

$$\frac{1}{x} + \frac{1}{(24-x)} = \frac{2}{9}$$

$$\frac{24x - x^2}{24} = \frac{2}{9}$$

$x^2 - 24x + 108 = 0$
$x = 6$ cm, 18 cm

6. (a)

The real depth = μ (apparent depth)
$\Rightarrow$ In first case, the real depth $h_1 = \mu(b-a)$
Similarly in the second case, the real depth $h_2 = \mu(d-c)$
Since $h_2 > h_1$, the difference of real depths
$= h_2 - h_1 = \mu(d - c - b + a)$

$$h_2 - h_1 = (d-b) \Rightarrow \mu = \frac{d-b}{(d-c-b+a)}$$

7. (b)

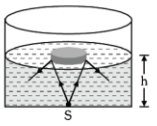
For objective lens $\dfrac{1}{f_0} = \dfrac{1}{v_0} - \dfrac{1}{u_0}$

$$\Rightarrow \quad \frac{1}{(+4)} = \frac{1}{v_0} - \frac{1}{(-4.5)} \Rightarrow v_0 = 36\text{cm}$$

$$\therefore \quad |m_D| = \frac{v_0}{u_0}\left(1 + \frac{D}{f_e}\right) = \frac{36}{4.5}\left(1 + \frac{24}{8}\right) = 32$$

8. (c)

Suppose the maximum height of the liquid is h for which the source is not visible.
Hence radius of the disc.



$$r = \frac{h}{\sqrt{\mu^2 - 1}} \quad \text{(condition of total internal reflection)}$$

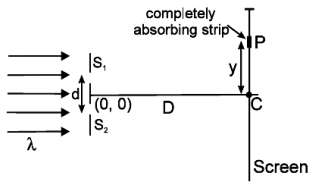
$$1 = \frac{h}{\sqrt{\left(\frac{5}{3}\right)^2 - 1}} \Rightarrow h = 1.33\,\text{cm}$$

9. (a)

Let I_0 be the intensity at P due to individual slits S_1 or S_2.
When waves due to both the sources superpose at P, the net intensity at P is

$I = 4I_0 \cos^2 \dfrac{\pi y}{\beta}$ where $\beta = \dfrac{\lambda D}{d}$

Since force on strip at P is twice due to individual source.



Hence $I = 2I_0$

$$\therefore \quad \cos^2 \frac{\pi y}{\beta} = \frac{1}{2} \quad \text{or} \quad \frac{\pi y}{\beta} = \frac{\pi}{4} \quad \text{or} \quad y = \frac{\beta}{4} = \frac{\lambda D}{4d}$$ **Ans.**

10. (c)

Here direction of light is given by normal vector $\vec{n} = \hat{i} + 2\hat{j} + 3\hat{k}$

$\therefore$ angle made by the $\vec{n}$ with y-axis is given by $\cos\beta = \dfrac{2}{\sqrt{1^2+2^2+3^2}} = \dfrac{2}{\sqrt{14}}$

11. (c)

At closest distance of approach
Kinetic energy = Potential energy

$$\Rightarrow \quad 5\times10^6 \times 1.6\times10^{-19} = \frac{1}{4\pi\varepsilon_0} \times \frac{(ze)(2e)}{r}$$

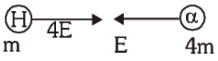
For uranium z= 92, so $r = 5.3 \times 10^{-12}$ cm

12. (d)

Energy of n^{th} sate in Hydrogen is same as energy of $3n^{th}$ state in Li^{++}.

$\therefore$ $3 \rightarrow 1$ transition in H would give same energy as the $3\times3 \rightarrow 1\times 3$ transition in Li^{++}.

13. (c)



$P_i = \sqrt{m.4.E} - \sqrt{4mE} = 0$

For completely inelastic collision both come to rest after collision and net energy of $4E + E = 10.5$ eV is lost. But electron in ground state of H-atom can accept only an energy of 10.2 eV. Hence the collision may be inelastic but it can never be perfectly inelastic.

14. (c)

Energy of photon is given by mc^2 now the maximum energy of photon is equal to the maximum energy of electron = eV

hence, $mc^2 = ev$

$\Rightarrow m = \frac{eV}{c^2} = \frac{1.6\times10^{-19}\times18\times10^3}{(3\times10^8)^2}$

$= 3.2 \times 10^{-32}$ kg

15. (d)

L, M levels are filled in tungsten. Hence to excite an electron from k level, energy supplied must be enough to drive to it to on unfilled higher level of negligible energy.

$\therefore$ Energy required $\simeq$ B.E. of k level

$= 69.5$ keV

$\therefore$ acceleration potential = 69.5 KV

16. (d)

$29^{Cu^{64}}$ is unstable due to excess neutron.

it will undergone β-decay.

$29^{Cu^{64}} \rightarrow 30^{Zn^{64}} + -1^{e^0} + \bar{\nu}$

17. (d)

$Pb^{200} \rightarrow x^{190} + 2^{He^4}$

From conservation of momentum

$0 = 4v_1 + 196v_2 \Rightarrow v_1 = -\frac{196}{4}v_2 = -49v_2$ .....(1)

$k_T = \frac{1}{2}\times4\times v_1^2 + \frac{1}{2}\times196\times v_2^2$ .....(2)

$k_d = \frac{1}{2}\times196\times v_2^2$ .....(3)

$$\frac{k_d}{k_T} = \frac{\frac{1}{2}\times196\times v_2^2}{\frac{1}{2}\times4\times v_1^2 + \frac{1}{2}\times196\times v_2^2} = \frac{49v_2^2}{v_1^2 + 49v_2^2}$$

$$\Rightarrow \frac{k_d}{k_T} = \frac{49v_2^2}{\left(\frac{196}{4}\right)^2 v_2^2 + 49v_2^2} = \frac{49v_2^2}{(49)^2v_2^2 + 49v_2^2}$$

$$\Rightarrow \frac{k_d}{k_T} = \frac{1}{49+1} = \frac{1}{50}$$

18. (a)

$x \rightarrow y + \alpha + n$

Apply momentum conservation

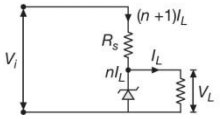
$p_i = 0$

$p_f = 4mv - mv + (mA - 5m)v'$

$p_i = p_f$

$$v' = \frac{3v}{A-5}$$

19. (c)



Voltage drop across Zener diode is V_L, so voltage drop across R_S is,

$$V_{RS} = V_i - V_L = (n+1)I_L R_S$$

$$\Rightarrow \quad R_S = \frac{V_i - V_L}{(n+1)I_L}$$

Hence, the correct answer is (C).

20. (d)

Electric energy density

$$u_e = \frac{1}{2}\varepsilon_0 E_{rms}^2$$

Since, $E_{rms} = \frac{E_0}{\sqrt{2}}$

$$\Rightarrow \quad u_e = \frac{1}{4}\varepsilon_0 E_0^2$$

Hence, the correct answer is (D).

Integer type

1. (4)

Let $^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}Y + e^- + \bar{\nu}$

$\Rightarrow \quad {}^{23}_{10}\text{Ne} \longrightarrow {}^{23}_{11}\text{Na} + e^- + \bar{\nu}$

$Q = \left[m(^{23}\text{Ne}) - m(^{23}\text{Na})\right] \times 931.5 \text{ MeV}$

$\Rightarrow \quad Q = 4.375 \text{ MeV} = 4.4 \text{ MeV}$

$\Rightarrow \quad Q \approx 4 \text{ MeV}$

Since, $Q = (KE)_Y + (KE)_e + E(\bar{\nu})$

As, $(KE)_Y$ is very very small, so

$Q \approx (KE)_e + E(\bar{\nu})$

When $(KE)_e$ is maximum, then $E(\bar{\nu})$ is negligible

$\Rightarrow \quad (KE)_e \approx Q = 4 \text{ MeV}$

2. (4)

$U = -1.7$ eV

$$\Rightarrow \quad E = \frac{U}{2} = -0.85 \text{ eV} = \frac{-13.6}{n^2}$$

$\Rightarrow \quad n = 4$

Ejected photoelectron will have minimum de-Broglie wavelength corresponding to transition from $n = 4$ to $n = 1$, so we have

$\Delta E = E_4 - E_1 = -0.85 - (-13.6) = 12.75$ eV

Using Einstein's Photo-Electric Equation, we get

$K_{max} = \Delta E - W = 10.45$ eV

$$\Rightarrow \quad \lambda = \sqrt{\frac{150}{10.45}} \text{ Å} \qquad \{\text{for an electron}\}$$

$\Rightarrow \quad \lambda = 3.8 \text{ Å} \approx 4 \text{ Å}$

3. (2)

Since, $n = \frac{N}{t} = \frac{P}{E} = \frac{P\lambda}{hc}$

$\Rightarrow \quad n = \frac{\left(1.7\times10^{-8}\right)\left(6000\times10^{-10}\right)}{\left(6.626\times10^{-34}\right)\left(3\times10^{8}\right)}$

$\Rightarrow \quad n = 5.1\times10^{10}$ photons per sec

$\Rightarrow \quad n \approx 5\times10^{10}$

$\Rightarrow \quad \alpha = 5$ and $\beta = 10$

$\Rightarrow \quad \frac{\beta}{\alpha} = 2$

4. (3)

Since, $g_p = \frac{GM_p}{R_p^2} = \frac{4}{3}G\pi R_p\rho_p$

$\Rightarrow \quad \frac{g_p}{g_e} = \frac{R_p\rho_p}{R_e\rho_e}$

Also, $v_e = \sqrt{2gR}$

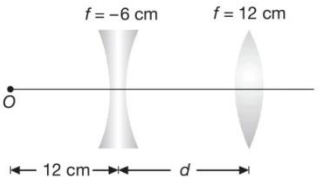
$\Rightarrow \quad \frac{v_p}{v_e} = \sqrt{\frac{g_pR_p}{g_eR_e}} = \left(\frac{g_p}{g_e}\right)\sqrt{\frac{\rho_e}{\rho_p}} = \frac{\sqrt{12}}{11}\times\sqrt{\frac{3}{4}}$

$\Rightarrow \quad \frac{v_p}{v_e} = \frac{2\sqrt{3}}{11}\times\frac{\sqrt{3}}{2} = \frac{3}{11}$

$\Rightarrow \quad v_p = 3 \text{ kms}^{-1}$

5. (8)

Applying lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ twice we get



$\frac{1}{v_1} - \frac{1}{-12} = \frac{1}{-6}$ ...(1)

$\frac{1}{\infty} - \frac{1}{v_1 - d} = \frac{1}{12}$ ...(2)

Solving equations (1) and (2), we get

$v_1 = -4$ cm

and $d = 8$ cm

Chemistry

1. d

As the temperature increases, K.E of reacting molecule increases Due to this probability of simultaneous collision increases.

2. c

$K_2 = A e^{-Ea_2/RT}$

$K_1 = A e^{-Ea_1/RT}$

$\frac{K_2}{K_1} = e^{(-Ea_2 + Ea_1)/RT}$

Since $Ea_2 = 2Ea_1$

$\therefore \frac{K_2}{K_1} = e^{-Ea_1/RT}$

or $K_1 = K_2 e^{Ea_1/RT}$

3. d

Conc. of Q is decreasing linearly hence order with respect to Q will be zero. It is only for 1st order that $t_{75\%} = t_{50\%}$ hence order wrt P is 1

overall order = 1+0 = 1

4. a

O.N of C in CO_2 is maximum so it cant act like reducing agent.

5. d

At anode :-

$Cu \rightarrow Cu^{2+} + 2e^-$

At cathode

$2H^+ + 2e^- \rightarrow H_2$

6. b

$E_{cell} = E^{\circ}_{cell} - \frac{0.059}{n} \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$

$y = c + mx$

Straight line graph with negative slope.

7. b

Ag^{+} & Cu^{2+} have different equivalent mass

8. d

$E^{\circ}_{cell} = 0.33 - 0.36 = -0.03$

$E = E^{\circ} - \frac{0.059}{n} \log Q$

At equilibrium $E = 0$

$0 = -0.03 - \frac{0.059}{2} \log K$

$\log K = -1$

$K = 10^{-1}$

$2ClO_3^- \rightleftharpoons ClO_2^- + ClO_4^-$

$t=0$	0.1	0	0
$t=eq$	$0.1-2x$	x	x

$K = \frac{x^2}{(0.1-2x)^2} = \frac{1}{10}$

$x = 0.019$

9. c

Higher the stability of carbocation, lesser will be the potential energy.

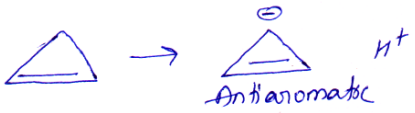
10. a

Conceptual question

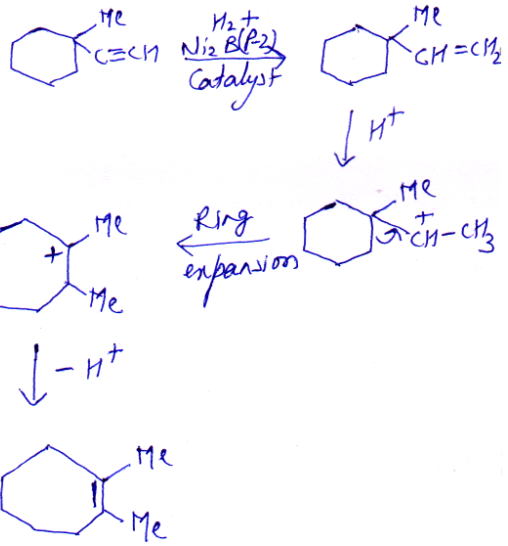
11. a

Conceptual question

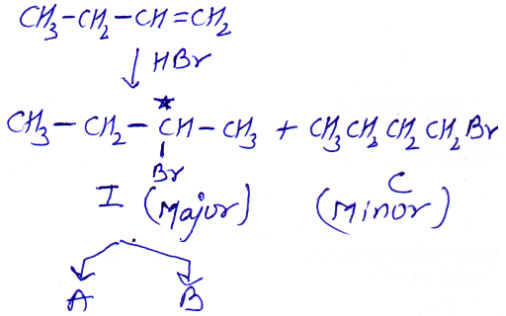
12. a



13. c



14. a



15. d

$CH_2=CH-CH=CH_2$

$\downarrow HBr$

$CH_2=CH-\overset{+}{C}H-CH_3$ (X)

$\updownarrow$

$\overset{+}{C}H_2-CH=CH-CH_3$ (Y)

Stability of Y which is more substituted is higher than X.

∴ Y is thermodynamic control

X is kinetic control

16. a

Third period has 3s & 3p subshell which has total 4 orbitals means $4 \times 3 = 12$

17. b

1st ionisation enthalpy

B < C < O < N

e^- gain enthalpy

I < Br < F < Cl

18. c

a) 1-Chloro-2,4-dinitrobenzene

b) 2-Chloro-4-nitromethylbenzene

d) 3-Ethyl-1,1-dimethylcyclohexane

19. a

Opposite Hydrogen are at perpendicular plane

20. d

Diethyl ether & butanone has different DBE

21. 4

$t_{99.9\%} = 10\ t_{50\%}$

22. 3

Let Be charge is +2

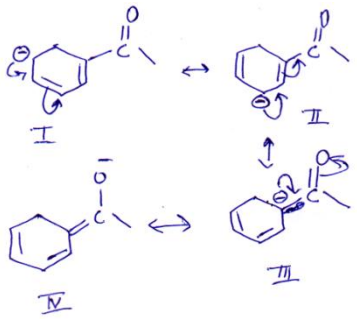
Al → +3

Si → +4

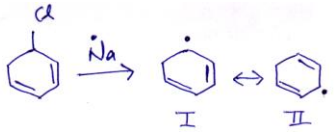
O → -2

n will be 3

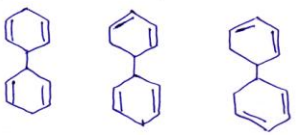
23. 4



24. 3



I & II will form 3 diff. product. 2 by self & 1 by cross



25. 4

It is one geometrical centre & one optical centre.

Total 4 stereoisomers will be formed

(+)E, (-)E, (+)Z, (-)Z

Mathematics

Do yourself