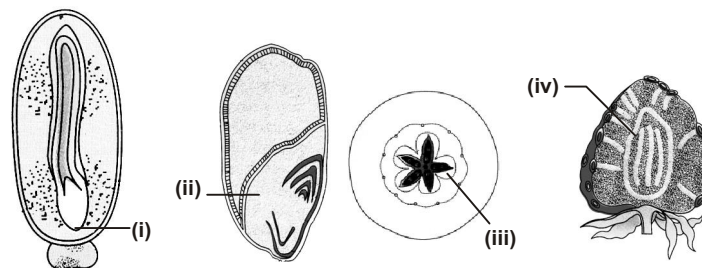## BIOLOGY

1. The given figures show the structures of some seeds and fruits. Select the correct option in which all the four parts (i), (ii), (iii) and (iv) are identified correctly.

	(i)	(ii)	(iii)	(iv)
(A)	Hypocotyl root axis	Endosperm	Endocarp	Achene
(B)	Root tip	Scutellum	Mesocarp	Thalamus
(C)	Shoot apical meristem	Scutellum	Thalamus	Achene
(D)	Root tip	Pericarp	Mesocarp	Micropyle

2. Select the correct match from the following

	Genetic disorder	Affected chromosome	Effects
(A)	Sickle-cell anaemia	7	Sickle-shaped WBC
(B)	Down's syndrome	22	Sterile female
(C)	Phenylketonuria	12	Mental retardation
(D)	Turner's syndrome	23	Super female

3. **Statement I :** A variety developed through pure line selection is characterized by complete phenotypic uniformity under varying environments.
   Statement II : A pure line variety is developed by self pollination from a single homozygous plant.

   (A) Both statements I and II are true and statement II is the correct explanation of statement I.

   (B) Both statements I and II are true but statement II is not the correct explanation of statement I.

   (C) Statement I is true but statement II is false.

   (D) Both statement I and statement II are false.

4. Which of the following statements are correct ?

   (i) Cell walls of Gram +ve bacteria contain teichoic acids.

   (ii) Cell walls of Gram +ve bacteria is not destroyed by penicillin.

   (iii) *Escherichia coli*, a non pathogenic bacterium is an example of Gram –ve bacteria.

   (iv) Cell walls of Gram +ve bacteria contain about 10% peptidoglycan.

   (A) (i) and (iv)   (B) (ii) and (iii)   (C) (ii) and (iv)   (D) (i) and (iii)

5. Plants do not store carbohydrates as glucose, because it

   (A) Dissolves in water, thereby altering the osmotic balance.

   (B) Attracts herbivorus insects.

   (C) Is an unstable molecule.

   (D) Would replace ribose in DNA synthesis.

6. Which of the following cell organelles constitute the part of endomembrane system?

(A) Peroxisomes, Golgi complex, mitochondria, lysosomes

(B) ER, mitochondria, lysosomes, vacuoles

(C) ER, Golgi complex, mitochondria, glyoxisomes

(D) ER, Golgi complex, lysosomes, vacuoles

---

7. Match column I with column II and select the correct option from the codes given below.

Column I	Column II
(a) CFC	(i) Measurement of strength of sewage
(b) MIC	(ii) Ozone layer depletion
(c) DDT	(iii) Non-degradable pollutant
(d) BOD	(iv) Bhopal gas tragedy
	(v) Global warming
	(vi) Biomagnification

(A) a-(v), b-(ii), c-(vi), d-(iv)

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

(C) a-(iii), b-(ii), c-(i), d-(vi)

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

8. Which of the following plants (i-vi) possess the given stomatal apparatus in their leaves ?

(i) Grasses (ii) Tomato

(iii) Banana (iv) Brinjal

(v) Soyabean (vi) Maize

(A) (i), (ii) & (v) (B) (ii), (iii) & (v) (C) (i), (iii) & (vi) (D) (iv), (v) & (vi)

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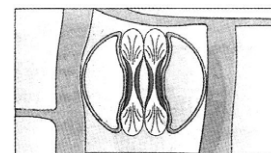
9. Given below are four statements (a - d) each with one or two blanks. Select the option which correctly fills up the blanks in two statements.

(a) Triple response is the bioassay of __(i)__ and, __(ii)__ is the precursor of this hormone.

(b) Genetic dwarfism is caused by __(i)__ of a single gene. If __(ii)__ is sprayed, it could be overcome.

(c) __(i)__ is an antigibberellin.

(d) Auxins like __(i)__ induces root initiation most efficiently whereas __(ii)__ is used as herbicide.

(A) (a)-(i) Auxin, (ii) Tryptophan
(d)-(i) IAA, (ii) 2,4-D

(B) (a)-(i) Ethylene, (ii) Methionine
(b)-(i) Mutation, (ii) Gibberellin

(C) (b)-(i) Small variation, (ii) Auxin
(c)-(i) Phosphon D

(D) (c)-(i) Phosphon D
(d)-(i) 2,4-D, (ii) IBA

---

10. Different parts of a leaf are modified into tendrils which help the plant in climbing up. Identify the type of tendril that is seen in *Clematis.*

(A) (B) (C) (D)
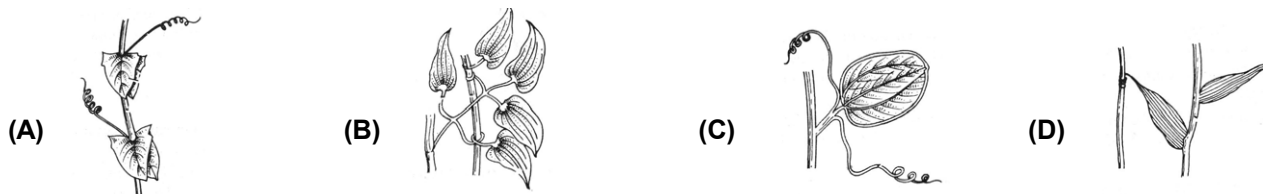
11. **Which of the following hormones does not match with its source and function?**

|	Hormone	Source	Function
(A)	Glucocorticoids	Adrenal cortex	Produces anti-inflammatory reactions
(B)	Vasopressin	Posterior pituitary	Stimulates resorption of water and electrolytes
(C)	Parathyroid hormone	Thyroid gland	Decreases the blood Ca^{2+} level
(D)	Melatonin	Pineal gland	Maintains sleep-wake cycle

12. **Identify the following animals and select the correct option.**
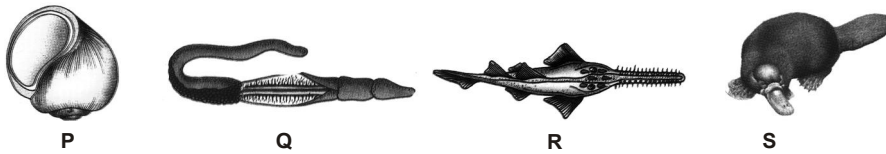
	P	Q	R	S
(A)	*Pila*	*Pristis*	*Ornithorhynchus*	*Balanoglossus*
(B)	*Pila*	*Balanoglossus*	*Pristis*	*Ornithorhynchus*
(C)	*Pila*	*Ornithorhynchus*	*Pristis*	*Balanoglossus*
(D)	*Pila*	*Balanoglossus*	*Ornithorhynchus*	*Pristis*

13. **Refer the given diagrammatic view of human skull and identify the skull bones labelled P, Q, R and S.**

	P	Q	R	S
(A)	Frontal	Temporal	Maxilla	Mandible
(B)	Occipital	Frontal	Mandible	Maxilla
(C)	Parietal	Temporal	Maxilla	Mandible
(D)	Temporal	Parietal	Mandible	Maxilla
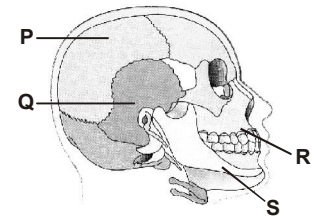
14. **Which of the following contraceptive methods correctly matches with its mode of action?**

	Contraceptive methods	Mode of action
(A)	Tubectomy	Makes the uterus unsuitable for implantation
(B)	Oral pills	Inhibit ovulation and implantation
(C)	Diaphragms	Spermicidal and increases phagocytosis of sperms within the uterus
(D)	IUD	Blocks gamete transport

15. **Menopause is the period in woman's life when ovulation and menstruation stops. What is the cause of menopause?**

    (A) Gradual increase in gonadotropin releasing hormone (GnRH)

    (B) Increase in androgen level

    (C) Decrease in oestrogen and progesterone level

    (D) Increase in gonadotropins (FSH and LH)

16. **In a population of 10,000 people, individuals suffering from autosomal recessive disease are 4900. What will be the number of heterozygous carrier individuals?**

    (A) 900   (B) 4200   (C) 2100   (D) 5100

4

17. The given figures (X & Y) show growth of cells in culture. Which of the following properties exhibited by cells of X is lost in cells of Y?

(A) Angiogenesis

(B) Oncogenesis

(C) Metastasis

(D) Contact inhibition
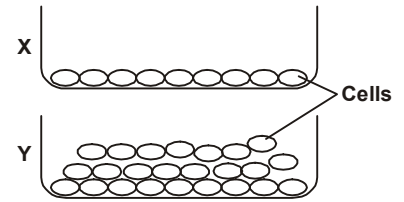
18. Which of the following types of respiration takes place in the frog during aestivation and hibernation?

(A) Cutaneous respiration

(B) Buccopharyngeal respiration

(C) Pulmonary respiration

(D) Both (A) and (C)

19. The vertebral column of human is formed by 26 serially arranged units called vertebrae. Which is the correct number of vertebrae in human?

(A) 8 cervical, 12 thoracic, 4 lumbar, 1 sacral and 1 caudal

(B) 7 cervical, 12 thoracic, 5 lumbar, 1 sacral and 1 coccygeal

(C) 8 cervical, 12 thoracic, 3 lumbar, 1 sacral and 2 caudal

(D) 7 cervical, 12 thoracic, 4 lumbar, 2 sacral and 1 coccygeal

20. The given figures show some processes occuring during gaseous- exchange in the human body. What are the phenomena X and Y called respectively ?
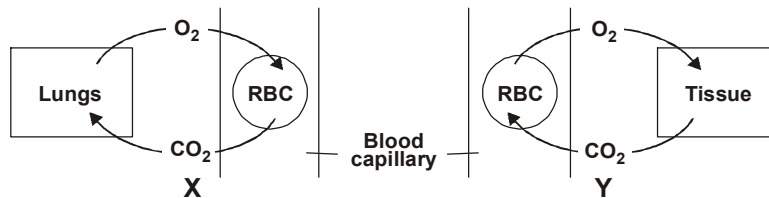
(A) X- Hamburger's phenomenon, Y- Bohr's effect

(B) X- Bohr's effect, Y- Haldane effect

(C) X- Haldane effect, Y- Bohr's effect

(D) X- Haldane effect, Y- Hamburger's effect

PHYSICS

21. In the figure shown, a parallel beam of light is incident on the plane of the slits of a Young's double slit experiment. Light incident on the slit, S_1 passes through a medium of variable refractive index $\mu = 1 + ax$ (where x is the distance from the plane of slits as shown), upto a distance l before falling on S_1. Rest of the space is filled with air. If at O a minima is formed, then the minimum value of the positive constant a (in terms of l and wavelength λ in air) is
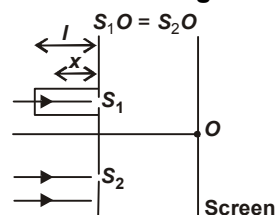
(A) $\dfrac{\lambda}{l}$

(B) $\dfrac{\lambda}{l^2}$

(C) $\dfrac{l^2}{\lambda}$

(D) None of these

22. The strings of a violin are tuned to the tones *G*, *D*, *A* and *E*, which are separated by a fifth from one another, that is $F(D) = 1.5\ F(G)$, $F(A) = 1.5\ F(D) = 400$ Hz and $F(E) = 1.5\ F(A)$. The distance between the two fixed points, the bridge at the scroll and over the body of the instrument is, 0.25 m, the tension on the string *E* is 90 N. The mass per unit length of string *E* is nearly

(A) 1 gm/m   (B) 2 gm/m   (C) 3 gm/m   (D) 4 gm/m

---

23. The figure here shows five paths traversed by a gas on a *P-V* diagram. ΔU_1, ΔU_2, ΔU_3, ΔU_4 and ΔU_5 are the change in internal energy of the gas in paths 1, 2, 3, 4 and 5 respectively, then
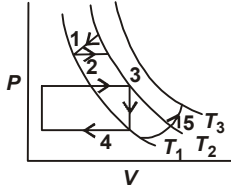
(A) $\Delta U_5 > \Delta U_3$ (B) $\Delta U_3 > \Delta U_5$ (C) $\Delta U_3 > \Delta U_2$ (D) $\Delta U_2 > \Delta U_5$

---

24. A closed compartment containing gas is moving with some acceleration in horizontal direction. Neglect effect of gravity. Then the pressure in the compartment is

(A) Same every where   (B) Lower in the front side

(C) Lower in the rear side   (D) Lower in the upper side

---

25. A body of weight *w* is kept on a rough inclined plane having an angle of inclination with horizontal, θ and friction coefficient μ. Force required to pull the body downwards is

(A) $w(\mu\cos\theta + \sin\theta)$ (B) $w(\mu\cos\theta - \sin\theta)$ (C) $w(\sin\theta - \mu\cos\theta)$ (D) $w(\mu\cos\theta + 2\sin\theta)$

---

26. An object of length 1 cm is placed on the principle axis of an equiconvex lens of radius 5 cm. Distance between the lens and object is 20 cm. Space between the lens and object is filled with two media of different refractive indices 2 and 1 as shown in the figure. Refractive index is 1 on the left and 2 on the right side of the lens. Boundary of both media is mid-way between the object and lens.
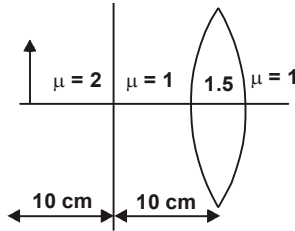

(A) The image will be formed at distance of 7.5 cm from the optical centre of lens.

(B) The image will be formed at distance of 10 cm from the optical centre of lens.

(C) The image will be formed at distance of 15.0 cm from the optical centre of lens.

(D) The image will be formed at distance of 12.5 cm from the optical centre of lens.

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27. A steady current *i* is flowing through a cylindrical element *ABC* as shown in the given figure. Select the correct relationship regarding this.
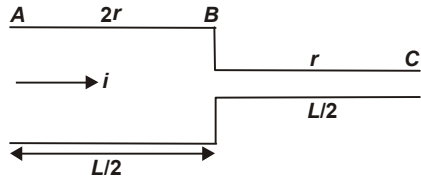
(A) $V_{AB} = 2V_{BC}$ (B) Power across *BC* is 4 times the power across *AB*

(C) Current densities in *AB* and *BC* are equal

(D) Electric fields due to current inside *AB* and *BC* are equal

28. **A bob of mass *M* is suspended by a massless string of length *L*. The horizontal velocity *v* at position *A* is just sufficient to make it reach the point *B*. The angle θ at which the speed of the bob is half of that at *A*, satisfies**
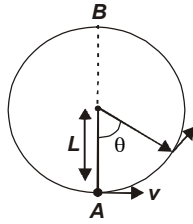
(A) $\theta = \dfrac{\pi}{4}$ (B) $\dfrac{\pi}{4} < \theta < \dfrac{\pi}{2}$ (C) $\dfrac{\pi}{2} < \theta < \dfrac{3\pi}{4}$ (D) $\dfrac{3\pi}{4} < \theta < \pi$

DIRECTION : Refer the following passage to answer Q. Nos. 29, 30 and 31.

Magnetic field in a cylindrical region is increasing at the rate of $\dfrac{dB}{dt}$ = 0.05 T/s as shown in figure. The radius of the cylindrical region is R_0 = 3 cm. A concentric non-conducting ring of radius $r = \dfrac{R_0}{2}$ is placed in this region.
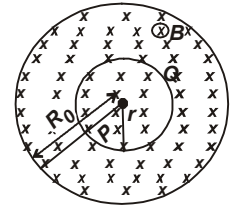
29. **The magnitude of induced electric field as a function of distance '*R*' from the centre is best represented by**

(A)   (B)   (C)   (D)

30. **The emf induced in the ring between the points *P* and *Q*, where $PQ = R_0$, is**

(A) Zero   (B) 7.08×10^{-5} V   (C) 3.54×10^{-5} V   (D) 1.76×10^{-5} V

31. **If a conducting rod of length R_0 is placed symmetrically about the centre along a diameter of the cylindrical region, their emf induced across the ends of the rod is**

(A) Zero   (B) 7.08×10^{-5} V   (C) 3.54×10^{-5} V   (D) 1.76×10^{-5} V

32. **Statement I : In ammeter, current in shunt is always greater than current in galvanometer.**
    Statement II : Value of shunt resistance is negative if current in shunt is less than current in galvanometer.

    (A) Both statements I and II are true and statement II is the correct explanation of statement I.

    (B) Both statements I and II are true but statement II is not the correct explanation of statement I.

    (C) Statement I is true but statement II is false.

    (D) Both statement I and statement II are false.

33. **Statement I : Specific heat of a substance during change of state is infinite.**
    Statement II : During change of state, $\Delta Q = mL$, specific heat does not come into play.

    (A) Both statements I and II are true and statement II is the correct explanation of statement I.

    (B) Both statements I and II are true but statement II is not the correct explanation of statement I.

    (C) Statement I is true but statement II is false.   (D) Both statement I and statement II are false.

34. Four capacitors and a battery are connected as shown in the figure. If the potential difference across the $7\,\mu F$ capacitor is 6 V, then match the following columns and select the correct option from the codes given below.
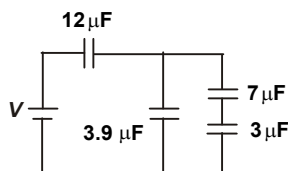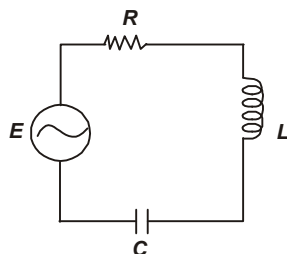

	Column I		Column II
(i)	The potential difference across the $12\,\mu F$ capacitor (in volt)	(p)	30
(ii)	The charge on the $3\,\mu F$ capacitor (in μC)	(q)	42
(iii)	The potential difference across the $3\,\mu F$ capacitor (in volt)	(r)	10
(iv)	The emf of the battery (in volt)	(s)	14

(A) (i) - (p), (ii) - (q), (iii) - (r), (iv) - (s)

(B) (i) - (q), (ii) - (s), (iii) - (p), (iv) - (r)

(C) (i) - (r), (ii) - (q), (iii) - (s), (iv) - (p)

(D) (i) - (s), (ii) - (r), (iii) - (q), (iv) - (p)

35. In the given LCR circuit, $R = 160\ \Omega, C = \dfrac{40}{\pi}\ \mu F, L = \dfrac{750}{\pi}$ mH, $f = 60$ Hz $E_m = 36$ V. Match the following columns regarding this and select the correct option from the codes given below.

	Column I		Column II
(i)	Current amplitude in A	(p)	0.8
(ii)	rms current in A	(q)	2.7
(iii)	Power factor	(r)	0.18
(iv)	Average power dissipated in the resistor in W	(s)	0.13

(A) (i) - (r), (ii) - (s), (iii) - (p), (iv) - (q)

(B) (i) - (s), (ii) - (p), (iii) - (q), (iv) - (r)

(C) (i) - (p), (ii) - (q), (iii) - (r), (iv) - (s)

(D) (i) - (q), (ii) - (r), (iii) - (s), (iv) - (p)

CHEMISTRY

36. An α-particle is accelerated through a potential difference of V volts. The de-Broglie's wavelength associated with it is

(A) $\sqrt{\dfrac{150}{V}}\ \mathring{A}$ (B) $\dfrac{0.286}{\sqrt{V}}\mathring{A}$ (C) $\dfrac{0.101}{\sqrt{V}}\mathring{A}$ (D) $\dfrac{0.983}{\sqrt{V}}\mathring{A}$

37. Statement I : Fe_2O_3 is more acidic than FeO.

Statement II : Higher the oxidation state, higher the electronegativity, thus non-metallic characteristic is higher.

(A) Both statements I and II are true and statement II is the correct explanation of statement I.

(B) Both statements I and II are true and statement II is not the correct explanation of statement I.

(C) Statement I is true but statement II is false.

(D) Statement I is false but statement II is true.

38. **The I_3^- ion has**

(A) Three equatorial lone pairs on the central iodine atom and two axial bond pairs in a pentagonal bipyramidal arrangement.

(B) Five equatorial lone pairs on the central iodine atom and two axial bond pairs in a pentagonal bipyramidal arrangement.

(C) Three equatorial lone pairs on the central iodine atom and two axial bond pairs in a trigonal bipyramidal arrangement.

(D) Two equatorial lone pairs on the central iodine atom and three axial bond pairs in a trigonal bipyramidal arrangement.

39. **Which of the following curves does not represent Boyle's law?**
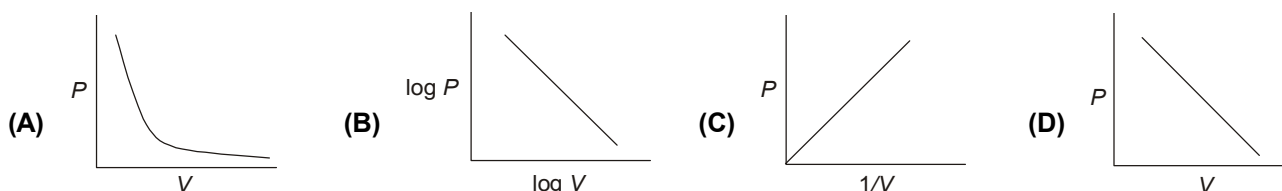
40. **Match column I with column II and select the correct option from the codes gives below.**

	Column I (Reaction)		Column II (Relation between K_p and K_c)
A.	$2NO \rightleftharpoons N_2 + O_2$	(P)	$K_p = K_c/RT$
B.	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	(Q)	$K_p = K_c RT$
C.	$PCl_3 + Cl_2 \rightleftharpoons PCl_5$	(R)	$K_p = K_c$
D.	$2O_3 \rightleftharpoons 3O_2$	(S)	$K_p = K_c(RT)^{1/2}$
E.	$SO_3 \rightleftharpoons SO_2 + 1/2 O_2$	(T)	$K_p = K_c(RT)^{-2}$.

(A) A-R; B-T; C-S; D-P; E-Q
(B) A-S; B-R; C-T; D-Q; E-P
(C) A-R; B-T; C-P; D-Q; E-S
(D) A-P; B-Q; C-R; D-S; E-T

41. **Statement I : Diborane reacts with ammonia to form an adduct, which on heating at 473 K decomposes to give a volatile compound called borazine.**

Statement II : Borazine is isoelectronic with benzene.

(A) Both statements I and II are true and statement II is the correct explanation of statement I.

(B) Both statements I and II are true and statement II is not the correct explanation of statement I.

(C) Statement I is true but statement II is false.

(D) Statement I is false but statement II is true.

42. **Given below are the structures of five organic compounds (1) to (5) which can undergo enolization.**

$PhCOCH_2COCH_3$, $PhCOCH_2CH_3$, $PhCOCH_2COOC_2H_5$,

(1)   (2)   (3)   (4)   (5)
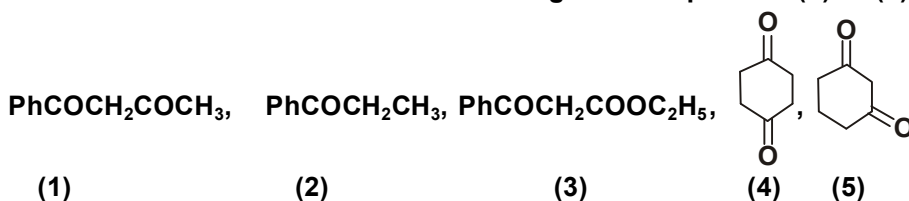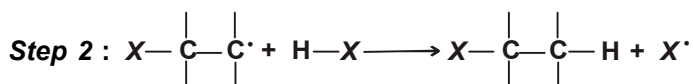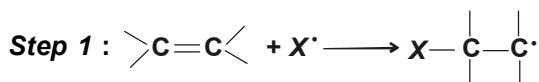
Select from the following the incorrect statement regarding the enolization of the above mentioned.

(A) (3) is extensively enolized as compared to (4)

(B) (4) is extensively enolized as compared to (5)

(C) (1) is extensively enolized as compared to (4)

(D) enol content of (3) is more than of (2)

43. **Simple distillation can be used to separate**

(A) A mixture of benzene (boiling point 80°C) and toluene (boiling point 110°C)

(B) A mixture of ether (boiling point 35°C) and toluene (boiling point 110°C)

(C) A mixture of ethanol (boiling point 78°C) and water (boiling point 100°C)

(D) None of these

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44. **The propagation steps involved in the free radical addition of HX across a double bond are:**

Step 1 : $\ce{>C=C<}$ + $X^{\cdot}$ $\longrightarrow$ $X-\overset{|}{\underset{|}{C}}-\overset{|}{\underset{|}{C}}^{\cdot}$

Step 2 : $X-\overset{|}{\underset{|}{C}}-\overset{|}{\underset{|}{C}}^{\cdot}$ + $H-X$ $\longrightarrow$ $X-\overset{|}{\underset{|}{C}}-\overset{|}{\underset{|}{C}}-H$ + $X^{\cdot}$

HCl does not follow free radical addition because

(A) Both steps are exothermic.

(B) Both steps are endothermic.

(C) Step-1 is exothermic and step-2 is endothermic.

(D) Step-2 is exothermic and step-1 is endothermic.

---

45. **The rate expression for the reaction $A_{(g)} + B_{(g)} \rightarrow C_{(g)}$ is rate = $k[A]^2[B]^{1/2}$. What changes in the initial concentrations of A and B will cause the rate of reaction to increase by a factor of eight ?**

(A) $[A'] = [A] : [B'] = 2[B]$

(B) $[A'] = 2[A] : [B'] = 4[B]$

(C) $[A'] = [A] : [B'] = 4[B]$

(D) $[A'] = 4[A] : [B'] = [B]$

---

46. **The following facts are available**

$2A^- + B_2 \rightarrow 2B^- + A_2$; $2C^- + B_2 \rightarrow$ No reaction; $2D^- + A_2 \rightarrow 2A + D_2$
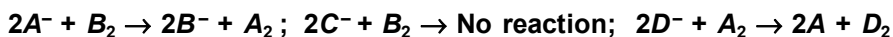
Which of the following statements is correct?

(A) $E_{C^-/C_2} > E_{B^-/B_2} > E_{A^-/A_2} > E_{D^-/D_2}$

(B) $E_{C^-/C_2} < E_{B^-/B_2} < E_{A^-/A_2} < E_{D^-/D_2}$

(C) $E_{C^-/C_2} < E_{B^-/B_2} > E_{A^-/A_2} > E_{D^-/D_2}$

(D) $E_{C^-/C_2} > E_{B^-/B_2} < E_{A^-/A_2} < E_{D^-/D_2}$

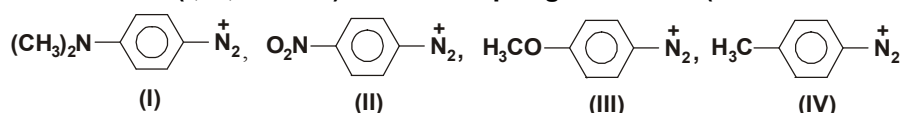47. **Which of the following statements is incorrect ?**

(A) $La(OH)_3$ is less basic than $Lu(OH)_3$.

(B) In lanthanoid series ionic radius of Ln^{3+} ions decreases.

(C) La is actually an element of transition series rather than lanthanoid series.

(D) Atomic radii of Zr and Hf are same because of lanthanoid contraction.

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48. **When a vapour at atmospheric pressure was gradually heated from 25°C its colour was found to deepen at first and then fade as the temperature was raised above 160°C. At 600°C, the vapour was almost colourless, but its colour deepened when the pressure was raised at this temperature. The vapour was**

(A) The bromine

(B) A mixture of nitrogen dioxide and dinitrogen tetroxide

(C) Pure nitrogen dioxide

(D) Pure dinitrogen tetroxide

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49. **The reactivities of the ions (I, II, III & IV) in azo-coupling reactions (under similar conditions) will be**

$(CH_3)_2N\text{—}\langle\bigcirc\rangle\text{—}\overset{+}{N}_2$, $O_2N\text{—}\langle\bigcirc\rangle\text{—}\overset{+}{N}_2$, $H_3CO\text{—}\langle\bigcirc\rangle\text{—}\overset{+}{N}_2$, $H_3C\text{—}\langle\bigcirc\rangle\text{—}\overset{+}{N}_2$

(I)　　　　　　(II)　　　　　　(III)　　　　　　(IV)

(A) I < IV < II < III

(B) I < III < IV < II

(C) III < I < II < IV

(D) III < I < IV < II

50. A ketone reacted with ethyl magnesium bromide (Grignard reagent) followed by hydrolysis gave a product which on dehydration gave an alkene. The alkene on ozonolysis gave diethyl ketone and acetaldehyde. The ketone is

(A) Dimethyl ketone (B) Ethyl methyl ketone (C) Diethyl ketone (D) Ethyl propyl ketone

<div align="center">SPACE FOR ROUGH WORK</div>

ANSWER KEYS

1.	(B)	2.	(C)	3.	(A)	4.	(D)	5.	(A)	6.	(D)	7.	(D)
8.	(C)	9.	(B)	10.	(B)	11.	(C)	12.	(B)	13.	(C)	14.	(B)
15.	(C)	16.	(B)	17.	(D)	18.	(A)	19.	(B)	20.	(C)	21.	(B)
22.	(A)	23.	(A)	24.	(B)	25.	(B)	26.	(A)	27.	(B)	28.	(D)
29.	(B)	30.	(D)	31.	(A)	32.	(A)	33.	(B)	34.	(C)	35.	(A)
36.	(C)	37.	(A)	38.	(C)	39.	(D)	40.	(C)	41.	(B)	42.	(B)
43.	(B)	44.	(C)	45.	(B)	46.	(B)	47.	(A)	48.	(D)	49.	(D)
50.	(C)												