

BIOLOGY

1. George Bentham and J.D. Hooker gave the most important natural system of classification of angiosperms. They arranged and classified all plants known at that time on the basis of all available natural affinities. This system has few drawbacks. This system is better than any artificial system of classification because

- (A) It places gymnosperms between dicots and monocots
- (B) It indicates phylogenetic relationships of different taxa
- (C) It often results in placing of unrelated organisms in a group
- (D) It does not employ characters from biochemistry and genetics

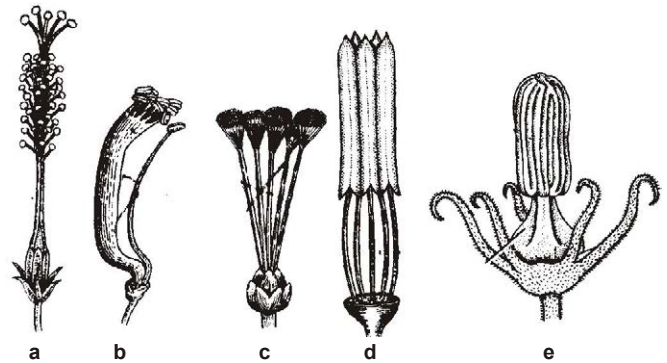
2. In the given paragraph, fill up the blanks and select the correct option.

The accepted mechanism used for the translocation of sugars from (i) to (ii) is called the pressure flow hypothesis. As (iii) is prepared by photosynthesis, it is converted to (iv). The sugar so formed then moves into the companion cells and then into the living phloem sieve tube cells by (v) transport.

- | | | | | |
|------------|--------|---------|---------|---------|
| (i) | (ii) | (iii) | (iv) | (v) |
| (A) Source | sink | starch | glucose | active |
| (B) Source | sink | glucose | starch | passive |
| (C) Sink | source | glucose | sucrose | passive |
| (D) Source | sink | glucose | sucrose | active |

3. The given figures (a-e) show different forms of the cohesion of stamens. Which of the following correctly represent the examples of each type ?

- (A) Brinjal, lily, China rose, sunflower, *Cucurbita*
- (B) China rose, pea, *Citrus*, sunflower, *Cucurbita*
- (C) China rose, pea, *Salvia*, mustard, *Citrus*
- (D) None of the above



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

- | Column I
(Cellular component) | Column II
(Function) |
|----------------------------------|-------------------------------------|
| (a) SER | (i) Digestion of unwanted materials |
| (b) Golgi apparatus | (ii) Formation of ATP |
| (c) Aleuroplasts | (iii) Formation of spindle fibres |
| (d) Mitochondria | (iv) Packaging of materials |
| (e) Lysosomes | (v) Synthesis of lipids |
| | (vi) Storage of proteins |
-
- | | |
|---|--|
| (A) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii), (e)-(v) | (B) (a)-(vi), (b)-(i), (c)-(v), (d)-(iii), (e)-(iv) |
| (C) (a)-(v), (b)-(iv), (c)-(vi), (d)-(ii), (e)-(i) | (D) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i), (e)-(vi) |

5. Which of the following pairs are incorrectly matched ?

Elements	Deficiency symptoms
(i) Calcium	Necrosis of leaf tissue
(ii) Manganese	Whiptail of leaves
(iii) Boron	Death of root and shoot tips
(iv) Molybdenum	Bushy habit of shoot

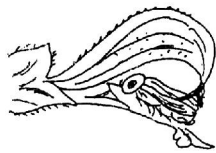
(A) (i) & (ii) (B) (ii) & (iii) (C) (ii) & (iv) (D) (iii) & (iv)

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

Column I	Column II
(a) Mendel	(i) Natural selection
(b) Johanssen	(ii) Term 'genetics'
(c) Darwin	(iii) Term 'gene'
(d) Bateson	(iv) Laws of heredity

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

7. The given figures show various stages of entomophily. Arrange the figures in correct sequence so as to give a complete step of entomophily



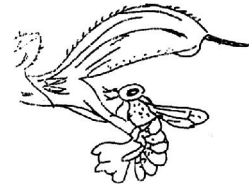
(i)



(ii)



(iii)



(iv)

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

8. Which of the following statements is/are not correct about the physiological effects of phytohormones?

- (i) Auxins promote parthenocarpy in a number of plants.
 (ii) Gibberellins promote the closure of stomata.
 (iii) Cytokinins slow down the process of senescence in plant parts.
 (iv) Ethylene helps in breaking bud dormancy.
 (v) ABA promotes the opening of stomata.
- (A) (i) & (iv) (B) (ii) & (v) (C) (iii) & (iv) (D) (ii) only

9. Which of the following problems is an exception to oppose the construction of Tehri dam and Sardar Sarovar project on the river Ganga and Narmada respectively ?

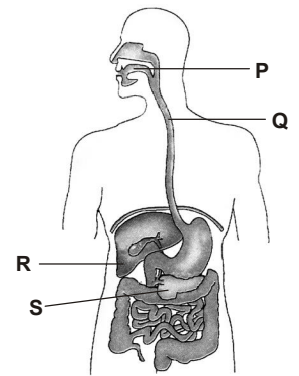
- (A) Submergence of large areas of agricultural land and human habitation
 (B) Destruction of large areas for industrial development
 (C) Displacement of large numbers of local population without adequate rehabilitation
 (D) Destruction of biological diversity

10. Which of the following is the ozone day ?

- (A) 6th August (B) 9th August (C) 16th September (D) 3rd December

11. Which labelled part in the given figure secretes a juice that does not contain any enzyme?

- (A) P
- (B) Q
- (C) R
- (D) S



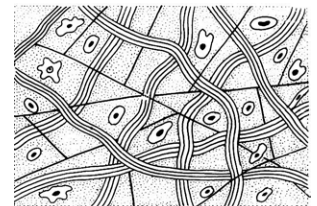
12. Which of the following statements is/are correct ?

- (i) Human beings have evolved from chimpanzees. (ii) Evolution should not be equated with progress.
- (iii) The wing of a bat and the wing of a bird are homologous organs.
- (iv) Darwin's theory gives us the mechanism for the inheritance of traits from one generation to the next and Mendel's experiments tell us how life evolved from simple to more complex forms.

- (A) (i) only
- (B) (ii) only
- (C) (iii) & (iv)
- (D) (i) & (iv)

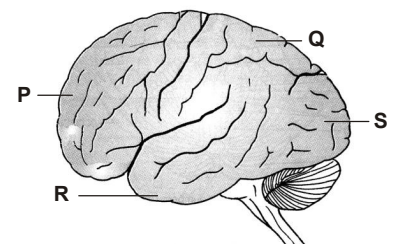
13. Which of the following statements is incorrect regarding the given figure of a tissue?

- (A) It is present under the skin as subcutaneous tissue
- (B) It is a fat storing tissue
- (C) It often serves as a support framework for epithelium
- (D) It provides strength, elasticity and support to the parts where this tissue is present



14. The given figure shows various cerebral lobes labelled as P, Q, R & S. Identify the functions of these lobes from the following list (i-iv) and select the correct option from the codes given below.

- (i) Registration of sensory perception of touch, pain, heat and cold.
- (ii) Decoding and interpretation of visual information, shape and colour.
- (iii) Reality testing by judgement, intellectual insight, ability to abstract, reasoning, decision making, expression of emotions, willpower & personality.
- (iv) Decoding and interpretation of sound, language comprehension, smell, memory and emotion.

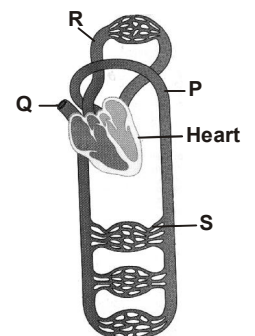


- (A) P-(i), Q-(ii), R-(iii), S-(iv)
- (B) P-(iv), Q-(iii), R-(ii), S-(i)
- (C) P-(iii), Q-(i), R-(ii), S-(iv)
- (D) P-(iii), Q-(i), R-(iv), S-(ii)

15. The given figure shows circulatory system. Identify the labelled parts (P-S) from the following list (i-vii) and select the correct option from the codes given below.

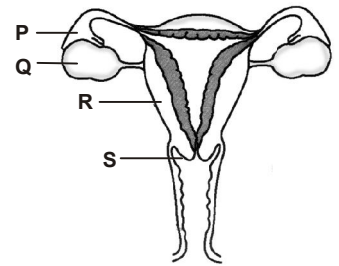
- (i) Pulmonary circulation
- (ii) Systemic circulation
- (iii) Superior vena cava
- (iv) Inferior vena cava
- (v) Aorta
- (vi) Veins and venules
- (vii) Arterioles and capillaries

- (A) P-(v), Q-(iii), R-(i), S-(vii)
- (B) P-(iii), Q-(iv), R-(i), S-(vi)
- (C) P-(v), Q-(iii), R-(ii), S-(vii)
- (D) P-(iii), Q-(v), R-(i), S-(vi)



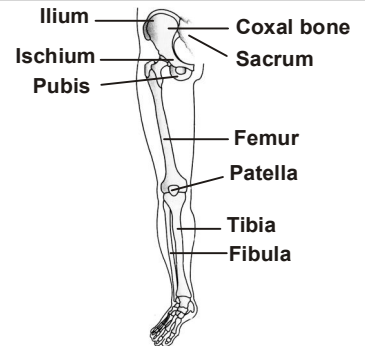
16. In which labelled part of the given figure, does the fertilization of egg take place?

- (A) P
- (B) Q
- (C) R
- (D) S



17. Identify the incorrectly labelled parts in the given figure.

- (A) Tibia and fibula
- (B) Pubis and ischium
- (C) Femur and patella
- (D) Ilium and pubis

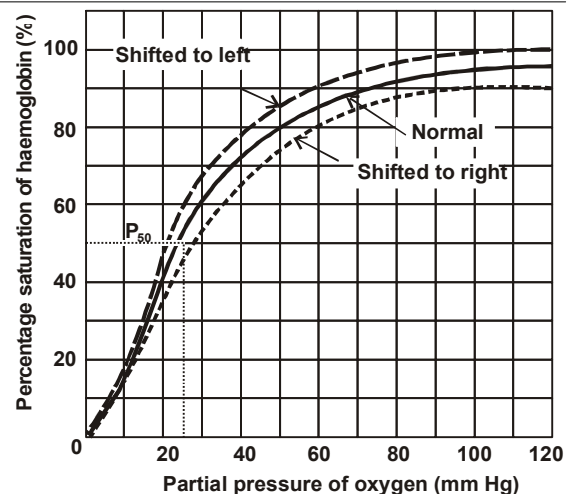


18. Which of the following match is correct ?

Structure	Description
(A) Septal nephridia and pharyngeal nephridia	Both are exonephric
(B) Typhlosole	Helps in grinding the soil particles and decaying leaves.
(C) Hepatic caeca	Blind tubules present at the junction of foregut and mid-gut in the alimentary canal of the cockroach.
(D) Gizzard	Internal median fold present in the dorsal wall of the intestine of earthworm

19. Which of the following statements are incorrect regarding the given figure?

- (i) At higher temperature the curve shifts to the right.
- (ii) Shifting of this curve to the right by increasing partial pressure of CO_2 is called chloride shift.
- (iii) Excess of 2, 3 diphosphoglycerate shifts the curve to the right.
- (iv) High pH shifts the curve to the left.
- (v) Decrease in partial pressure of O_2 shifts the curve to the left.



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

20. Statement I : In the descending limb of loop of Henle, the urine is hypertonic, while in ascending limb of loop of Henle, the urine is hypotonic.

Statement II : Descending limb is impermeable to Na^+ , while ascending limb is impermeable to H_2O .

- (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.

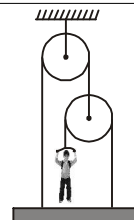
PHYSICS

21. A thick-walled hollow sphere has outside radius R_0 . It rolls down an incline without slipping and its velocity at the bottom is v_0 . Now the incline is waxed so that it is practically frictionless and the sphere is observed to slide down (without rolling) the same incline when its speed at the bottom is observed to be $\frac{5v_0}{4}$. The radius of gyration of the hollow sphere about an axis through its centre is

- (A) $\frac{R_0}{2}$ (B) $\frac{2R_0}{3}$ (C) $\frac{3R_0}{4}$ (D) $\frac{4R_0}{5}$

22. In the given diagram, with what force must the man pull the rope to hold the plank in position? Weight of the man is 60 kgf. Neglect the weights of plank, rope and pulley.

- (A) 20 kgf (B) 30 kgf
(C) 60 kgf (D) 15 kgf

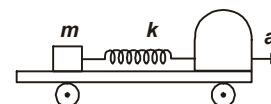


23. A sound wave passes from a medium A to another medium B. The velocity of sound in B is greater than that in A. Assume that there is no absorption or reflection at the boundary. As the wave moves across the boundary

- (A) The frequency of sound will not change (B) The wavelength will increase
(C) The wavelength will decrease (D) The intensity of sound will not change

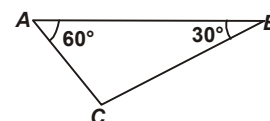
24. One end of an ideal spring is connected with a smooth block and the other end with rear wall of driving cabin of a truck as shown in the figure. Initially, the system is at rest. If truck starts to accelerate with a constant acceleration then the block (relative to truck)

- (A) Will remain stationary
(B) Will start oscillating with constant amplitude
(C) Will start oscillating with increasing amplitude
(D) Moves such that the length of the spring first increases and then becomes constant



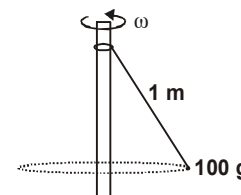
25. ACB is right-angled prism with other angles as 60° and 30° . The refractive index of prism is 1.5. AB has a thin layer of liquid on it as shown. Light falls normally on the face AC . For total internal reflection, maximum refractive index of the liquid is

- (A) 1.4 (B) 1.3 (C) 1.2 (D) 1.6



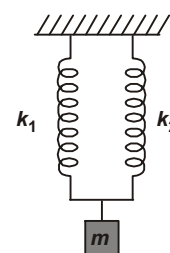
26. A string of length 1 m is fixed at one end and carries a mass of 100 g at the other end. The string makes $(2/\pi)$ revolutions per second around vertical axis through the fixed end. What is the tension in the string?

- (A) 1.6 N (B) 0.8 N
(C) 3.2 N (D) 2.4 N

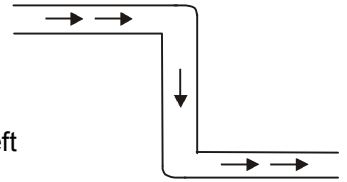


27. In the arrangement shown in the figure, for vertical oscillation of the mass m , the time period is

- (A) $T = 2\pi \sqrt{\frac{m(k_1 + k_2)}{k_1 k_2}}$ (B) $T = 2\pi \sqrt{\frac{k_1 + k_2}{m}}$
(C) $T = 2\pi \sqrt{\frac{m}{k_1 + k_2}}$ (D) $T = 2\pi \sqrt{\frac{mg}{k_1 + k_2}}$



28. The tube shown is of uniform cross-section. Liquid flows through it at a constant speed in the direction shown by the arrows. The liquid exerts on the tube



- (A) A net force to the right
 (B) A net force to the left
 (C) A clockwise torque
 (D) An anticlockwise torque

DIRECTION : Read the following paragraph to answer Q. nos. 29, 30 and 31.

Projectile motion is a combination of two one dimensional motions-one in horizontal and other in vertical direction. Motion in 2 dimensions means motion in a plane. Necessary condition for 2 dimensional motion is that the velocity vector is coplanar to the acceleration vector. In case of projectile motion, the angle between velocity and acceleration will be $0^\circ < \theta < 180^\circ$. During the projectile motion the horizontal component of velocity remains unchanged but vertical component of velocity is time dependent.

29. A particle is projected from the origin in x - y plane. Acceleration of particle in negative y direction is α . If equation of path of the particle is $y = ax - bx^2$, then initial velocity of the particle is

- (A) $\sqrt{\frac{\alpha}{2b}}$ (B) $\sqrt{\frac{\alpha(1+a^2)}{2b}}$ (C) $\sqrt{\frac{\alpha}{a^2}}$ (D) $\sqrt{\frac{\alpha b}{a^2}}$

30. An object is projected from origin in x - y plane in which velocity changes according to relation $\vec{v} = a\hat{i} + bx\hat{j}$. Path of particle is

- (A) Hyperbolic (B) Circular (C) Elliptical (D) Parabolic

31. A body is projected at angles of 30° and 60° with same velocity. Their horizontal ranges are R_1 and R_2 , and maximum heights are H_1 and H_2 respectively. Then,

- (A) $\frac{R_1}{R_2} > 1$ (B) $\frac{H_1}{H_2} > 1$ (C) $\frac{R_1}{R_2} < 1$ (D) $\frac{H_1}{H_2} < 1$

32. **Statement I :** A solid and hollow sphere of same diameter and same material when heated through the same temperature will expand by the same amount.

Statement II : The change in volume is independent of the original mass but depends on original volume.

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

33. **Statement I :** When a bottle of cold carbonated drink is opened, a slight fog forms around the opening.

Statement II : Adiabatic expansion of the gas causes lowering of temperature and condensation of water vapours.

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

34. Some physical quantities are given in column I and some possible SI units in which these quantities may be expressed are given in column II. Match the columns and select the correct option from the codes given below.

Column I	Column II
(i) GM_eM_s , where G = universal gravitational constant, M_e = mass of the Earth, M_s = mass of the Sun	(p) Joule
(ii) $\frac{3RT}{M}$, where R = universal gas constant, T = absolute temperature, M = molar mass	(q) $\text{kg m}^3 \text{s}^{-2}$
(iii) $\frac{I\omega^2}{2}$, where I = moment of inertia ω = angular velocity of rotation	(r) $\text{m}^2 \text{s}^{-2}$
(iv) $\frac{GM_e}{R_e^2}$, where G = universal gravitational constant, M_e = mass of the Earth, R_e = radius of the Earth	(s) m s^{-2}
(A) (i) - (p), (ii) - (q), (iii) - (r), (iv) - (s)	(B) (i) - (q), (ii) - (r), (iii) - (p), (iv) - (s)
(C) (i) - (r), (ii) - (p), (iii) - (s), (iv) - (q)	(D) (i) - (s), (ii) - (r), (iii) - (q), (iv) - (p).

35. Column I gives some devices and column II gives some processes on which the functioning of these devices depend. Match the device in column I with the processes in column II and select the correct option from the codes given below.

Column I	Column II
(i) Bimetallic strip	(p) Radiation from a hot body
(ii) Steam engine	(q) Energy conversion
(iii) Incandescent lamp	(r) Melting
(iv) Electric fuse	(s) Thermal expansion of solids
(A) (i) - (p), (ii) - (q), (iii) - (r), (iv) - (s)	(B) (i) - (q), (ii) - (s), (iii) - (p), (iv) - (r)
(C) (i) - (r), (ii) - (p), (iii) - (s), (iv) - (q)	(D) (i) - (s), (ii) - (q), (iii) - (p), (iv) - (r)

CHEMISTRY

36. Match both the columns and mark the correct option from the codes given below.

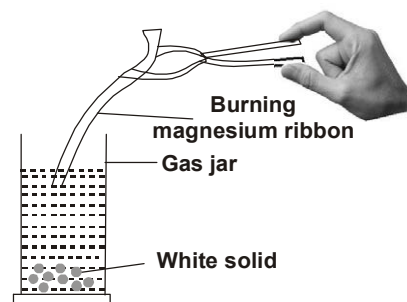
Column I	Column II
(a) Action of dilute sulphuric acid on Zn	(i) Ammonia
(b) Heating limestone	(ii) Oxygen
(c) Heating potassium chlorate	(iii) Hydrogen
(d) Heating ammonium chloride	(iv) Carbon dioxide
a	b
c	d
(A) (ii) (iv) (i) (iii)	
(B) (iii) (iv) (ii) (i)	
(C) (iv) (iii) (i) (ii)	
(D) (iii) (i) (iv) (ii)	

37. **Statement I** : pH of hydrochloric acid solution is less than that of acetic acid solution of the same concentration.
Statement II : In equimolar solutions, the number of titratable protons present in hydrochloric acid is less than that present in acetic acid.
- (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) Statement I is false but statement II is true.

38. Cupric carbonate upon heating gives a black residue *X* and a colourless gas *Y*. When residue *X* is dissolved in dilute sulphuric acid, blue solution was formed. This upon evaporation gave blue crystals of compound *Z*. The gas *Y* when passed into aqueous solution of *W*, turned the solution milky and when more of gas *Y* was passed into milky liquid, it turned colourless again. Identify *X*, *Y*, *Z* and *W*.

	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>
(A)	CuO	CO ₂	CaCO ₃	Ca(HCO ₃) ₂
(B)	CuO	CO ₂	CuSO ₄	Ca(OH) ₂
(C)	CuSO ₄	CuO	CO ₂	CuCO ₃
(D)	CuCO ₃	CuO	CO ₂	Ca(HCO ₃) ₂

39. A student wants to test the nature of the oxides formed by reactions of metals and non-metals with oxygen. He burns a magnesium ribbon by holding it with a pair of tongs and collects the white solid formed in a gas jar. He then adds a small amount of water to the jar and tests it with the help of a litmus paper. What will happen to the litmus paper?



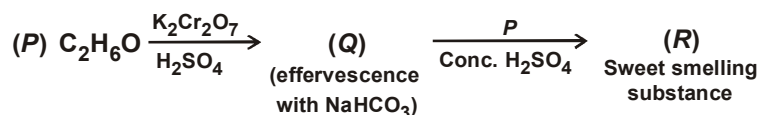
- (A) Red litmus paper turns blue.
 (B) Blue litmus paper turns red.
 (C) First red litmus turns blue and then again red. (D) No change in the colour of litmus paper.

40. The given table shows the position of six elements *P*, *Q*, *R*, *S*, *T* and *U* in the periodic table. Using the table identify the incorrect statement.

Group	1	2	3-12	13	14	15	16	17	18
Period									
2		<i>P</i>					<i>Q</i>		<i>R</i>
3		<i>S</i>				<i>T</i>			<i>U</i>

- (A) Element *S* present in group 2 is a metal and it exhibits a valency of 2.
 (B) The element *T* present in group 15 is a non-metal and it exhibits a valency of 3.
 (C) Element *S* has bigger atomic radius than element *T*. (D) Elements *R* and *U* are known as halogens.
41. A student poured some bromine water in a test tube. He passed vapours of two hydrocarbons from the jars *X* and *Y*, one after the other. He observed that on passing vapours from jar *Y* the reddish brown colour of bromine got discharged. When he reacted both the gases separately with oxygen, he observed that both the gases on combustion gave carbon dioxide and water vapour. What inference does he draw from his experiments?
- (A) Jar *X* contains a saturated hydrocarbon while jar *Y* contains unsaturated hydrocarbon.
 (B) Jar *X* contains an unsaturated hydrocarbon while jar *Y* contains saturated hydrocarbon.
 (C) Jar *X* and *Y* contain saturated hydrocarbons. (D) Jar *X* and *Y* contain unsaturated hydrocarbons.

42. A neutral organic compound *P* of molecular formula C_2H_6O on oxidation with potassium dichromate and sulphuric acid gives a compound *Q* which gives brisk effervescence with sodium bicarbonate. Compound *P* is an important constituent of wine and it reacts with *Q* to give a sweet smelling substance *R*. *P*, *Q* and *R* respectively are



- (A) *P* – CH_3COOH , *Q* – C_2H_5OH , *R* – $C_2H_5COOCH_3$
 (B) *P* – CH_3CH_2OH , *Q* – CH_3CH_2COOH , *R* – $CH_3CH_2COOCH_3$
 (C) *P* – CH_3CH_2COOH , *Q* – CH_3CH_2OH , *R* – $CH_3COOCH_2CH_3$
 (D) *P* – CH_3CH_2OH , *Q* – CH_3COOH , *R* – $CH_3COOCH_2CH_3$
-
43. Aluminium carbonate reacts with dilute nitric acid to form aluminium nitrate, water and carbon dioxide. The reaction can be written as $Al_2(CO_3)_3 + xHNO_3 \longrightarrow yAl(NO_3)_3 + zCO_2 + 3H_2O$
 The stoichiometric constants *x*, *y* and *z* are
 (A) 6, 2, 4 (B) 6, 2, 3 (C) 2, 4, 6 (D) 4, 2, 3
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44. The structural formula of ethyl ethanoate is

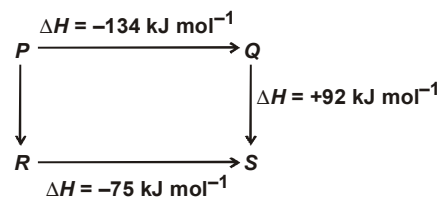


45. '*M*' g of an element gave '*N*' g of oxide. Equivalent weight of the element is

(A) $\frac{M+N}{M} \times 8$ (B) $\frac{M}{N+M} \times 8$ (C) $(N-M) \times 8$ (D) $\frac{M}{N-M} \times 8$

46. The given diagram illustrates the energy changes of a set of reactions. Which of the following statements is incorrect ?

- (A) The enthalpy change for the reaction $P \rightarrow R$ is $+33 \text{ kJ mol}^{-1}$.
 (B) The enthalpy change for the transformation $R \rightarrow Q$ will be endothermic.
 (C) The enthalpy change for the transformation $P \rightarrow Q$ is -134 kJ mol^{-1} .
 (D) The enthalpy change for the transformation $S \rightarrow P$ will be $+42 \text{ kJ mol}^{-1}$.



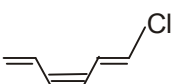
47. For two gases, *A* and *B* with molecular weights M_A and M_B , it is observed that at a certain temperature *T*, the mean velocity of *A* is equal to the u_{rms} of *B*. Thus, the mean velocity of *A* can be made equal to the mean velocity of *B*, if
 (A) *A* is at temperature *T* and *B* at *T'*; $T > T'$ (B) Both *A* and *B* are raised to a higher temperature
 (C) Both *A* and *B* are lowered in temperature (D) None of these
-

48. *Al* and *Ga* have nearly the same covalent radii because of

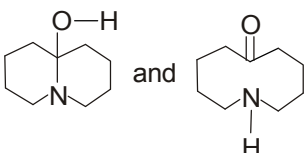
- (A) Greater shielding effect of *s* electrons of *Ga* atoms (B) Poor shielding effect of *s* electrons of *Ga* atoms
 (C) Poor shielding effect of *d* electrons of *Ga* atoms (D) Greater shielding effect of *d* electrons of *Ga* atoms
-

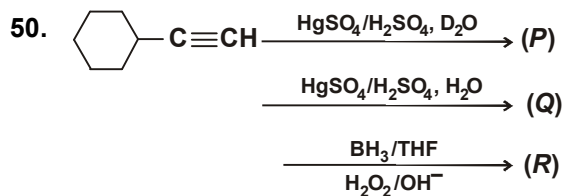
49. Which of the following statements is incorrect ?

(A) Phenol is more acidic than *p*-cresol.

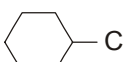
(B)  forms white precipitate with $\text{Ag}^+_{(aq)}$ most readily

(C) $\text{CH}_3\ddot{\text{N}}\text{H}_2$ is more basic than $\text{CH}_3-\ddot{\text{N}}=\text{CHCH}_3$

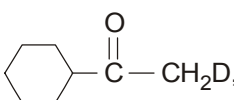
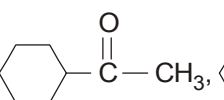
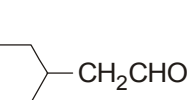
(D)  are not resonating structures of each other

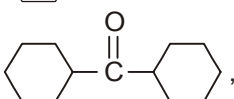
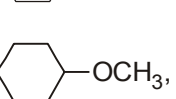
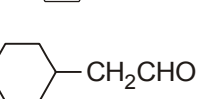


(P), (Q) and (R) respectively are

(A)  CH_2CHO in all cases

(B)  COCH_3 in all cases

(C) , , 

(D) , , 

SPACE FOR ROUGH WORK

