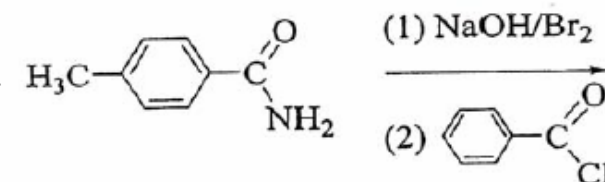SECTION – I (Single Correct Choice Type)

1. The complex showing a spin-only magnetic moment of 2.82 B.M. is

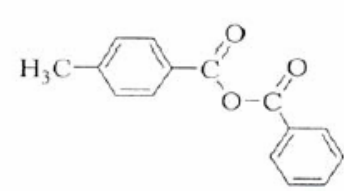   A) $Ni(CO)_4$　　　　　B) $[NiCl_4]^{2-}$　　　　　C) $Ni(PPh_3)_4$　　　　　D) $[Ni(CN)_4]^{2-}$
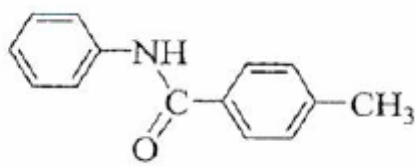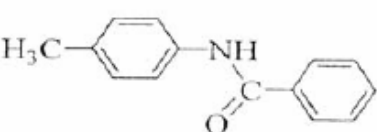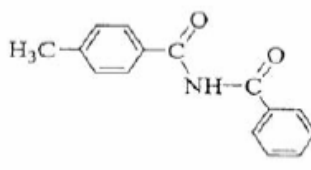
   ANSWER: B

2. The species having pyramidal shape is

   A) SO_3　　　　　B) BrF_3　　　　　C) SiO_3^{2-}　　　　　D) OSF_2
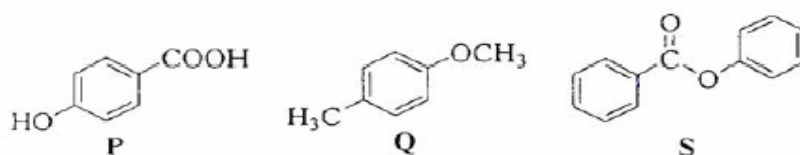
   ANSWER: D
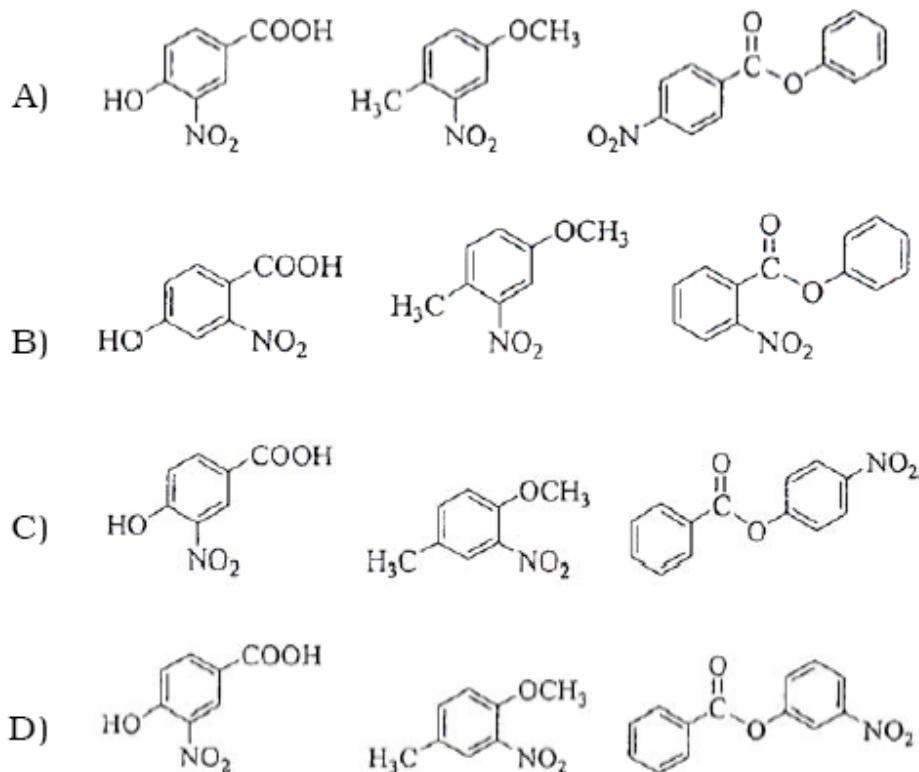
3. In the reaction

the structure of the Product T is
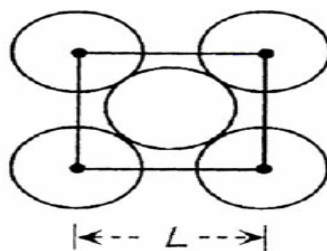
A)

B)

C)

D)

   ANSWER: C

4. The compounds P, Q and S

were separately subjected to nitration using HNO_3/H_2SO_4 mixture. The major product formed in each case respectively, is

A)

B)

C)

D)

ANSWER: C

5. The packing efficiency of the two-dimensional square unit cell shown below is

A) 39.27%   B) 68.02%   C) 74.05%   D) 78.54%
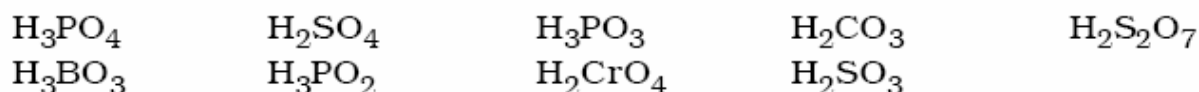
ANSWER: D

6. Assuming that Hund's rule is violated, the bond order and magnetic nature of the diatomic molecule B_2 is

    A) 1 and diamagnetic   C) 1 and paramagnetic

    B) 0 and diamagnetic   D) 0 and paramagnetic

ANSWER: A

SECTION – II (Integer Type)

7. The total number of diprotic acids among the following is

H_3PO_4	H_2SO_4	H_3PO_3	H_2CO_3	$H_2S_2O_7$
H_3BO_3	H_3PO_2	H_2CrO_4	H_2SO_3	

ANSWER: 6

8. Total number of geometrical isomers for the complex $[RhCl(CO)(PPh_3)(NH_3)]$ is

ANSWER: 3

9. Among the following, the number of elements showing only one non-zero oxidation state is

    O,   Cl,   F,   N,   P,   Sn,   Tl,   Na,   Ti

ANSWER: 2

10. Silver (atomic weight $= 108$ g mol^{-1}) has a density of 10.5 g cm^{-3}. The number of silver atoms on a surface of area 10^{-12} m^2 can be expressed in scientific notation as $y \times 10^x$. The value of x is

ANSWER: 7

11. One mole of an ideal gas is taken from **a** to **b** along two paths denoted by the solid and the dashed lines as shown in the graph below. If the work done along the solid line path is w_s and that along the dotted line path is w_d, then the integer closest to the ratio w_d/w_s is
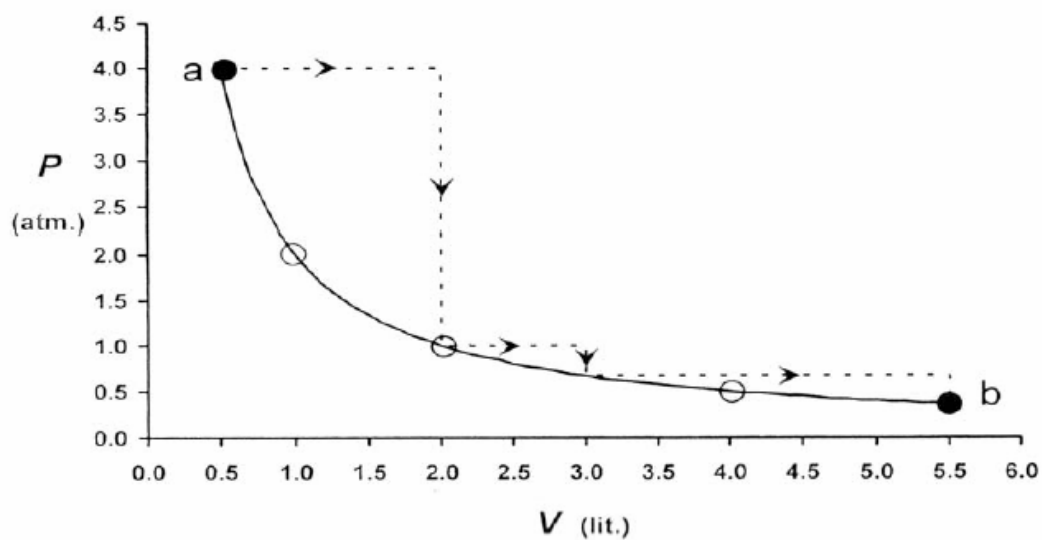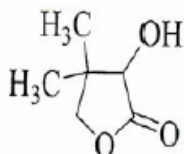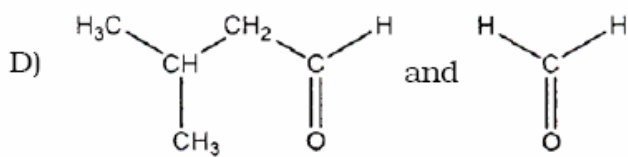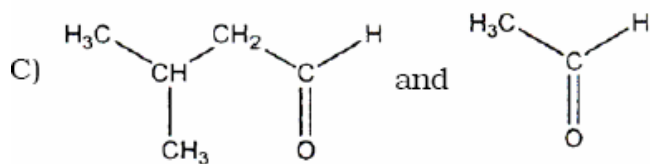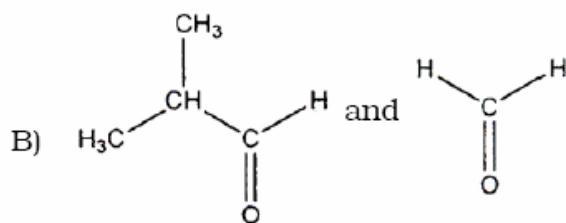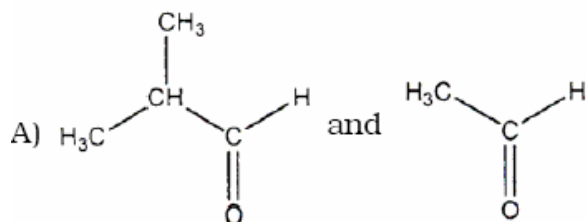

ANSWER: 2

SECTION – III (Paragraph Type)

Paragraph for Questions 12 to 14.

Two aliphatic aldehydes P and Q react in the presence of aqueous K_2CO_3 to give compound R, which upon treatment with HCN provides compound S. On acidification and heating, S gives the product shown below :
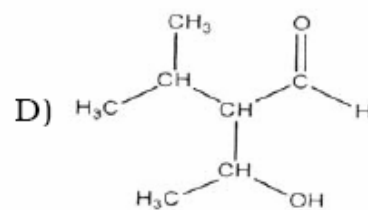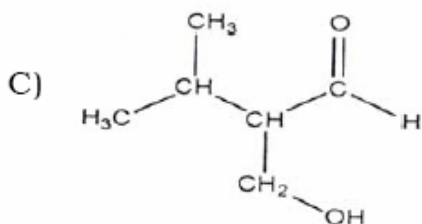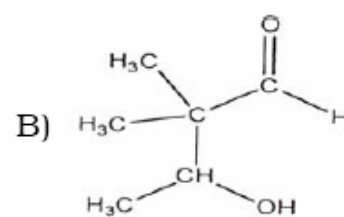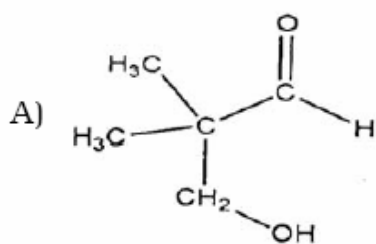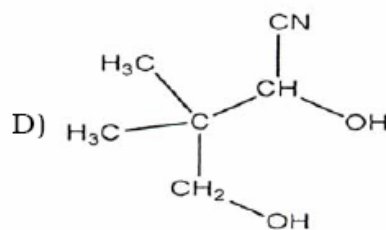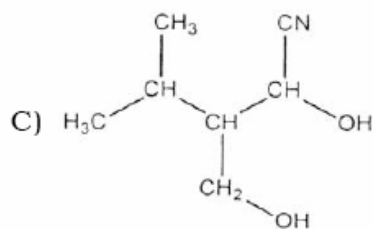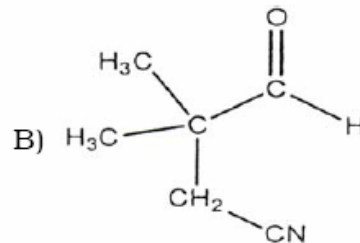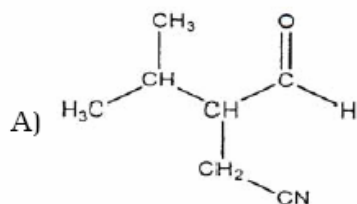

12. The compounds P and Q respectively are

A) and

B) and

C) and

D) and

ANSWER: B

13. The compound R is

A)

B)

C)

D)

ANSWER: A

14. The compound S is

A)

B)

C)

D)

ANSWER: D

Paragraph for Questions 15 to 17.

The hydrogen-like species Li^{2+} is in a spherically symmetric state S_1 with one radial node. Upon absorbing light the ion undergoes transition to a state S_2. The state S_2 has one radial node and its energy is equal to the ground state energy of the hydrogen atom.

15. The state S_1 is

    A) 1s   B) 2s   C) 2p   D) 3s

ANSWER: B

16. Energy of the state S_1 in units of the hydrogen atom ground state energy is

    A) 0.75   B) 1.50   C) 2.25   D) 4.50

ANSWER: C

17. The orbital angular momentum quantum number of the state S_2 is
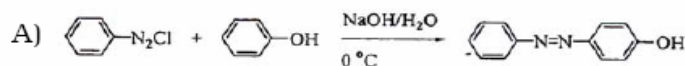
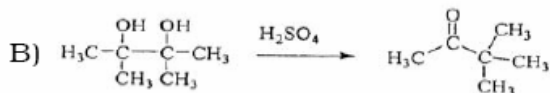   A) 0   B) 1   C) 2   D) 3

ANSWER: B

SECTION – IV (Matrix Type)

18. Match the reactions in Column I with appropriate options in Column II.
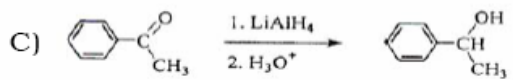
Column I	Column II
A)	p) Racemic mixture
B)	q) Addition reaction
C)	r) Substitution reaction
D)	s) Coupling reaction
	t) Carbocation intermediate

ANSWER:
     A: **r and s**
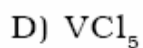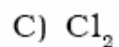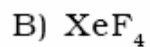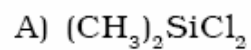   **B:**   **t**
     C: **p and q**
     D: **r**

19. All the compounds listed in **Column I** react with water. Match the result of the respective reactions with the appropriate options listed in **Column II**.

Column I	**Column II**
A) $(CH_3)_2SiCl_2$	p) Hydrogen halide formation
B) XeF_4	q) Redox reaction
C) Cl_2	r) Reacts with glass
D) VCl_5	s) Polymerization
	t) O_2 formation

ANSWER:

A: p and s
B: p and q and r and t
C: p and q
D: p