

12<sup>TH</sup> – JEE/NEET

**TOPIC :- Coordination Compounds (DPP)**

**DPP-01 : General introduction of complex salts and definitions to be used :**

- An example of double salt is :  
 (1) Bleaching powder    (2)  $K_4[Fe(CN)_6]$     (3) Hypo    (4) Potash alum
- Which of the following is not a double salt but is a complex salt :  
 (1)  $KCl.MgCl_2.6H_2O$     (2)  $FeSO_4.(NH_4)_2SO_4.6H_2O$   
 (3)  $K_2SO_4.Al_2(SO_4)_3.2H_2O$     (4)  $4KCN.Fe(CN)_2$
- Ethylene diamine is an example of a ..... ligand :  
 (1) monodentate    (2) bidentate    (3) tridentate    (4) hexadentate
- Which of the following represents the monodentate monoanion ligand ?  
 (1) Carbonato    (2) Ammonia    (3) Nitrito    (4) Oxalato
- The co-ordination number and oxidation number of 'x' in the following compound  $[x(SO_4)(NH_3)_5]Cl$  will be:  
 (1) 10 & 3    (2) 2 & 6    (3) 6 & 3    (4) 6 & 4
- The oxidation state of Fe in brown ring complex  $[Fe(H_2O)_5NO]SO_4$  is :  
 (1) + 1    (2) + 2    (3) + 3    (4) + 4
- The oxidation state of Mo in its oxo-complex species  $[Mo_2O_4(C_2H_4)]^{2-}$  is :  
 (1) +2    (2) +3    (3) +4    (4) +5
- All ligands are :  
 (1) lewis acids    (2) lewis bases    (3) neutral    (4) none
- Which of the following are bidentate monoanion ligands ?  
 (a) Dimethylglyoximato  
 (b) Oxalato ion  
 (c) Bis(ethane-1,2-diamine)  
 Select the correct answer using the codes given below :  
 (1) a only    (2) a and c only    (3) c only    (4) b and c only
- An ambidentate ligand is one which :  
 (1) is linked to the metal atom at two points.  
 (2) has two donor atoms but only one of them has the capacity to form a coordinate bond.  
 (3) has two donor atoms but either of the two can form a coordinate bond.  
 (4) forms chelate rings.
- Which of the following has five donor (coordinating) sites?  
 (1) Triethylene tetramine    (2) Ethylenediamine tetraacetate ion  
 (3) Ethylenediamine triacetate ion    (4) Diethylene triamine

12. Which of the following is not correctly matched ?  
 (1)  $\text{NO}_2^-$  – Bidentate ligand (2) Ethylenediamine – Bidentate ligand  
 (3)  $\text{SCN}^-$  – Monodentate ligand (4) (CO) – Monodentate ligand

13. What is the charge on the complex  $[\text{Co}(\text{NH}_3)\text{Cl}(\text{gly})_2]$  formed by Co(III) :  
 (1) +3 (2) 0 (3) +2 (4) –1

14. Consider the following :

Complex	Coordination number
(A) $[\text{CuCl}_2]^-$	(i) 6
(B) $\text{Ni}(\text{CO})_4$	(ii) 5
(C) $[\text{PtCl}_6]^{4-}$	(iii) 4
(D) $[\text{Ni}(\text{NH}_3)_6]^{2+}$	(iv) 2

Proper matching is :

- (1) A(i), B(ii), C(iii), D(iv) (2) A(iii), B(iv), C(ii), D(iv)  
 (3) A(iv), B(iii), C(i), D(i) (4) A(i), B(iii), C(ii), D(iv)

## DPP-02 : Nomenclature of coordination compounds

1. What is the chemical formula of bis(ethane-1,2-diamine)oxalatochromium(III) ?  
 (1)  $[\text{Cr}(\text{en})_2(\text{OX})]$  (2)  $[\text{Cr}(\text{OX})_2(\text{en})]^-$  (3)  $[\text{Cr}(\text{en})_2(\text{OX})]^+$  (4)  $[\text{Cr}(\text{en})_2(\text{OX})]^-$
2. Trioxalatoaluminate(III) and tetrafluoro-borate(III) ions are :  
 (1)  $[\text{Al}(\text{C}_2\text{O}_4)_3]$ ,  $[\text{BF}_4]^{3-}$  (2)  $[\text{Al}(\text{C}_2\text{O}_4)_3]^{3+}$ ,  $[\text{BF}_4]^{3+}$  (3)  $[\text{Al}(\text{C}_2\text{O}_4)_3]^{3-}$ ,  $[\text{BF}_4]^-$  (4)  $[\text{Al}(\text{C}_2\text{O}_4)_3]^{2-}$ ,  $[\text{BF}_4]^{2-}$
3. A complex cation is formed by Pt (in some oxidation state) with ligands (in proper number so that coordination number of Pt becomes six). Which of the following can be its correct IUPAC name :  
 (1) Diammineethylenediaminedithiocyanato-S-platinum (II) ion  
 (2) Diammineethylenediaminedithiocyanato-S-platinum (IV) ion  
 (3) Diammineethylenediaminedithiocyanato-S-platinum (IV) ion  
 (4) Diamminebis (ethylenediamine) dithiocyanate-S- platinum (IV) ion
4. The IUPAC name for the coordination compound  $\text{Ba}[\text{BrF}_4]_2$  is:  
 (1) Barium tetrafluorobromate (V) (2) Barium tetrafluorobromate (III)  
 (3) Barium bis (tetrafluorobromate) (III) (4) none of these
5. The IUPAC name of  $[\text{Co}(\text{NH}_3)_3\text{Br Cl}(\text{NO}_2)]$  will be :  
 (1) Triamminebromidochloridonitrito-N-cobaltate(III)  
 (2) Triamminebromidochloridonitrito-N-cobalt(III)  
 (3) Triamminebromidochloridonitrito-O-cobaltate(III)  
 (4) Triamminenitrito-O-bromidochloridocobaltate(III)
6. A complex anion is formed by chromium (in some oxidation state) with ligands (in proper number so that coordination number of chromium becomes six). Which of the following can be its correct IUPAC name?  
 (1) pentachloridonitridochromium(VI) (2) pentachloridonitridochromate(VI)  
 (3) azidopentachloridochromate(VI) (4) None of these

7. Complex ion  $[\text{FeN}_3(\text{O}_2)(\text{SCN})_4]^{4-}$  is named as :  
 (1) azidosuperoxidotetrathiocyanato-S-ferrate(II) (2) azidodioxigentetrathiocyanatoferrate(III)  
 (3) azidoperoxidotetrathiocyanato-S-ferrate(II) (4) azidodioxidotetrathiocyanato-S-ferrate(III)
8. The correct IUPAC name of complex,  $[\text{Rh}(\text{en})_2(\text{ONO})(\text{SCN})]\text{NO}_3$  is :  
 (1) diethane-1, 2-diamine nitrito-O-thiocyanato-S-rhodium (III) nitrate  
 (2) bis(ethane-1, 2-diamine) nitrito-O-thiocyanato-S-rhodium(III) nitrate  
 (3) bis(ethane-1, 2-diamine) nitrito-O-thiocyanato-S-rhodate(III) nitrate  
 (4) bis(ethane-1, 2-diamine) nitrito -N-thiocyanato-N-rhodium(II) nitrate.
9. The IUPAC name of the complex ion  $[\text{Cr}(\text{NO}_2)(\text{NH}_3)(\text{CN})_4]^{2-}$  is :  
 (1) amminetetracyanidonitrito-O-chromate (III).  
 (2) amminetetracyanidonitrito-N-chromate(III)  
 (3) amminetetracyanidonitrito-N-chromium(III)  
 (4) amminetetracyanidonitrito-N-chromate(II)

**DPP-03 : Bonding in coordination compounds :  
 (Initial bonding theories and EAN rule, Valence bond theory)**

1. In a complex the correct statements :  
 (1) primary valency is ionisable (2) primary valency is non-ionisable  
 (3) secondary valency is ionisable (4) All of these
2. According to Werner's theory, the secondary valencies of a central metal atom correspond to its:  
 (1) oxidation state (2) co-ordination number  
 (3) any of the two (1) and (2) (4) neither of the two
3. The molecular formula of various hexacoordinate complexes are given as below.  
 (1)  $\text{CrCl}_3 \cdot 6\text{NH}_3$  (2)  $\text{CrCl}_3 \cdot 5\text{NH}_3$  (3)  $\text{CrCl}_3 \cdot 4\text{NH}_3$   
 If the number of  $\text{NH}_3$  ligands attached to central metal ion respectively are 6, 5 and 4, then the primary valencies in (1), (2) and (3) respectively are :  
 (1) 3, 3, 3 (2) 0, 1, 2 (3) 3, 2, 1 (4) 6, 5, 4
4. When  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  ionises in water, the number of ions produced are :  
 (1) 4 (2) 6 (3) 3 (4) 2
5. EAN of the central metal in the complexes –  $\text{K}_2[\text{Ni}(\text{CN})_4]$ ,  $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$  and  $\text{K}_2[\text{PtCl}_6]$  are respectively:  
 (1) 36, 35, 86 (2) 34, 35, 84 (3) 34, 35, 86 (4) 34, 36, 86
6. Effective atomic number of Fe in  $[\text{Fe}(\text{CO})_4]^-$  is :  
 (1) 34 (2) 35 (3) 36 (4) 37
7. In which of the following pairs of complexes, the central metals/ions do not have same effective atomic number ?  
 (1)  $[\text{Cr}(\text{CO})_6]$  and  $[\text{Fe}(\text{CO})_5]$  (2)  $[\text{Cu}(\text{CN})_4]^{3-}$  and  $[\text{Ni}(\text{CO})_4]$   
 (3)  $[\text{Co}(\text{NH}_3)_6]^{2+}$  and  $[\text{Ni}(\text{NH}_3)_6]^{2+}$  (4)  $[\text{V}(\text{CO})_6]^-$  and  $[\text{Co}(\text{NO}_2)_6]^{3-}$
8. In which of the following complexes the valence shell of central metal ion does not have  $d^6$  electronic configuration?  
 (1)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  (2)  $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$  (3)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  (4)  $[\text{Ni}(\text{H}_2\text{O})_6]^{4+}$

9. Hybridisation of Fe in  $K_3[Fe(CN)_6]$  and  $K_4[Fe(CN)_6]$  respectively are :  
 (1)  $d^2sp^3$  and  $sp^3d^2$       (2)  $d^2sp^3$  and  $d^2sp^3$       (3)  $sp^3d^2$  and  $sp^3d^2$       (4)  $sp^3d^2$  and  $d^2sp^3$
10. The hybridisation of  $[CoF_6]^{3-}$  and  $[Co(C_2O_4)_3]^{3-}$  are :  
 (1) Both  $sp^3d^2$       (2) Both  $d^2sp^3$       (3)  $sp^3d^2$  and  $d^2sp^3$       (4)  $d^2sp^3$  and  $sp^3d^2$
11.  $[FeF_6]^{3-}$  has Fe atom ---hybridised with unpaired ----electrons :  
 (1)  $d^2sp^3$ , 4      (2)  $d^2sp^3$ , 5      (3)  $sp^3d^2$ , 5      (4)  $sp^3d^2$ , 3
12. Hybridisation of  $[Ni(NH_3)_6]^{2+}$  and  $[Zn(NH_3)_6]^{2+}$  are :  
 (1) both  $d^2sp^3$       (2) both  $sp^3d^2$   
 (3)  $d^2sp^3$  and  $sp^3d^2$  respectively      (4)  $sp^3d^2$  and  $d^2sp^3$  respectively
13. A complex of platinum, ammonia and chloride produces four ions per molecule in the solution. The structure consistent with the observation is:  
 (1)  $[Pt(NH_3)_4]Cl_4$       (2)  $[Pt(NH_3)_2Cl_4]$       (3)  $[Pt(NH_3)_5Cl]Cl_3$       (4)  $[Pt(NH_3)_4Cl_2]Cl_2$
14. A complex compound which is formed by nitrate and ammonia ligands, gives 2 mol precipitate of AgBr, when reacts with  $AgNO_3$ , the formula of complex is :  
 (1)  $[Co(NH_3)_5(NO_3)]Br_2$       (2)  $[Co(NH_3)_3Br]Br(NO_3)$       (3)  $[Co(NH_3)_4Br_2]NO_3$       (4) None of these

#### DPP-04 : Crystal field theory & applications of crystal field theory :

(Theory Magnetic moment of complex, Color of complex, Stability of complex)

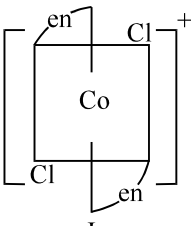
1. In the spectrochemical series, the magnitude of the crystal field splitting is maximum for which ion ?  
 (1)  $Cl^-$       (2)  $F^-$       (3)  $NO_2^-$       (4)  $CN^-$
2. Among the following, which one has higher CFSE?  
 (1)  $[Zn(NH_3)_4]^{2+}$       (2)  $[Zn(OH)_4]^{2-}$       (3)  $[Zn(CN)_4]^{2-}$       (4) All of these
3. The outer complexes are generally formed by :  
 (1) strong ligand      (2) weak ligands      (3) neutral ligands      (4) none
4. The most stable complex among the following is :  
 (1)  $[NiCl_4]^{2-}$       (2)  $[Ni(H_2O)_2Cl_2]$       (3)  $[Ni(NH_3)_4]^{2+}$       (4)  $[Ni(CN)_4]^{2-}$
5.  $[Sc(H_2O)_6]^{3+}$  ion is :  
 (1) coloured and paramagnetic      (2) colourless and paramagnetic  
 (3) colourless and diamagnetic      (4) coloured and octahedral
6. The purple colour of  $[Ti(H_2O)_6]^{3+}$  in aqueous solution is due to :  
 (1) d-d transition of unpaired d-electron      (2) charge transfer spectrum  
 (3) intermolecular vibration      (4) polarisation of cation.
7. The complex with highest stability constant at 298 K is :  
 (1)  $[CdCl_4]^{2-}$       (2)  $[CdBr_4]^{2-}$       (3)  $[CdI_4]^{2-}$       (4)  $[Cd(CN)_4]^{2-}$

8. The geometry and magnetic moment of the complexes  $[\text{NiCl}_4]^{2-}$  and  $[\text{PdCl}_4]^{2-}$  respectively are :  
 (1) tetrahedral, square planar ; 2.83, 0                      (2) tetrahedral, tetrahedral ; 2.83, 2.83  
 (3) square planar, tetrahedral ; 0, 2.83                      (4) square planar, square planar : 0, 0
9. Which of the following statements is correct with respect to the crystal field theory ?  
 (1) It considers only the metal ion d-orbitals and gives no consideration at all to other metal orbitals.  
 (2) It cannot account for the  $\pi$  bonding in complexes.  
 (3) The ligands are point charges which are either ions or neutral molecules.  
 (4) All of these
10. Which one of the following statements is incorrect ?  
 (1)  $[\text{Co}(\text{NH}_3)_6]^{3+}$ ,  $[\text{Co}(\text{CN})_6]^{3-}$  and  $[\text{Co}(\text{NO}_2)_6]^{3-}$  are diamagnetic involving  $d^2sp^3$  hybridisation.  
 (2)  $[\text{Zn}(\text{NH}_3)_4]^{2+}$ ,  $[\text{FeCl}_4]^-$  and  $[\text{Ni}(\text{CO})_4]$  are diamagnetic involving  $sp^3$  hybridisation.  
 (3) The magnetic moment of  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$  is 5.92 B.M and that of  $[\text{Fe}(\text{CN})_6]^{3-}$  is 1.73  
 (4) The magnetic moment of  $\text{K}_4[\text{MnF}_6]$  and  $\text{K}_3[\text{FeF}_6]$  are same.
11. All the following complex ions are found to be paramagnetic :  
 P :  $[\text{FeF}_6]^{3-}$  ;                      Q :  $[\text{CoF}_6]^{3-}$   
 R :  $[\text{V}(\text{H}_2\text{O})_6]^{3+}$  ;                      S :  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$   
 The correct order of their paramagnetic moment (spin only) is :  
 (1)  $P > Q > R > S$                       (2)  $P < Q < R < S$                       (3)  $P = Q = R = S$                       (4)  $P > R > Q > S$
12. In which of the following complex ion, the metal ion will have  $t_{2g}^6, e_g^0$  configuration according to CFT:  
 (1)  $[\text{FeF}_6]^{3-}$                       (2)  $[\text{Fe}(\text{CN})_6]^{3-}$                       (3)  $[\text{Fe}(\text{CN})_6]^{4-}$                       (4) None of these
13. Among  $\text{TiF}_6^{2-}$ ,  $\text{CoF}_6^{3-}$ ,  $\text{Cu}_2\text{Cl}_2$  and  $\text{NiCl}_4^{2-}$  the colourless species are:  
 (1)  $\text{CoF}_6^{3-}$  and  $\text{NiCl}_4^{2-}$                       (2)  $\text{TiF}_6^{2-}$  and  $\text{CoF}_6^{3-}$                       (3)  $\text{NiCl}_4^{2-}$  and  $\text{Cu}_2\text{Cl}_2$                       (4)  $\text{TiF}_6^{2-}$  and  $\text{Cu}_2\text{Cl}_2$

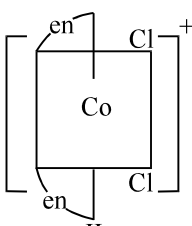
### DPP-05 : Isomerism in coordination compounds :

#### (Structural Isomerism, Stereoisomerism, Geometrical Isomerism, Optical Isomerism)

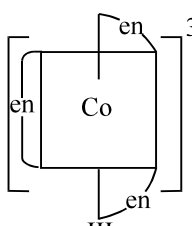
1.  $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$  and  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$  are examples of which of the following type of isomerism?  
 (1) Optical                      (2) Linkage                      (3) Coordination                      (4) Ionization
2. Change in composition of co-ordination sphere yields which type of isomers ?  
 (1) Hydrate                      (2) Optical                      (3) Geometrical                      (4) None of these
3. Which of the following cannot show linkage isomerism ?  
 (1)  $\text{H}_2\text{O}$                       (2)  $\text{CN}^-$                       (3)  $\text{SCN}^-$                       (4)  $\text{NO}_2^-$
4. The number of geometrical isomers of  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$  is :  
 (1) 1                      (2) 3                      (3) 4                      (4) 2

5. Which of the following complex will show optical activity ?  
 (1)  $\text{trans} - [\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$  (2)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$   
 (3)  $\text{cis} - [\text{Co}(\text{NH}_3)_2(\text{en})_2]^{3+}$  (4)  $\text{trans} - [\text{Co}(\text{NH}_3)_2(\text{en})_2]^{3+}$
6. Which of the following complex ions does not show optical activity :  
 (1)  $[\text{PtBrClI}(\text{NO}_2)(\text{H}_2\text{O})\text{NH}_3]$  (2)  $\text{cis}[\text{Co}(\text{en})_2\text{Cl}_2]^+$   
 (3)  $\text{cis}[\text{Co}(\text{en})(\text{NH}_3)_2\text{Cl}_2]^+$  (4)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$
7. Which of the following complex shows ionization isomerism?  
 (1)  $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$  (2)  $[\text{Cr}(\text{en})_2]\text{Cl}_2$  (3)  $[\text{Cr}(\text{en})_3]\text{Cl}_3$  (4)  $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$
8. Which of the following pairs show co-ordination isomerism ?  
 (1)  $[\text{Co}(\text{NH}_3)_6] [\text{Cr}(\text{CN})_6]$  and  $[\text{Mn}(\text{NH}_3)_6] [\text{Co}(\text{CN})_6]$   
 (2)  $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_2\text{Cl}]\text{Br}_2$  and  $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})\text{ClBr}]\text{Br} \cdot \text{H}_2\text{O}$   
 (3)  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Br}_2$  and  $[\text{Pt}(\text{NH}_3)_3\text{Br}_2]\text{Cl}_2$   
 (4)  $[\text{Co}(\text{NH}_3)_6] [\text{Cr}(\text{C}_2\text{O}_4)_3]$  and  $[\text{Cr}(\text{NH}_3)_6] [\text{Co}(\text{C}_2\text{O}_4)_3]$
9. Which kind of isomerism is shown by the complex  $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{SO}_4^-$  ?  
 1. Ionisation isomerism 2. Linkage isomerism  
 3. Geometrical isomerism 4. Optical isomerism  
 (1) 1, 2, 3 and 4 are correct (2) 1, 3 and 4 are correct only  
 (3) 1 and 2 are correct only (4) 2, 3 and 4 are correct only
10. The number of geometrical isomers for octahedral  $[\text{Co}(\text{NH}_3)_2\text{Cl}_4]^-$ , square planar  $\text{AuCl}_2\text{Br}_2^-$  are :  
 (1) 3, 3 (2) 2, 2 (3) 3, 2 (4) 2, 3
11. How many isomers are possible for the complex ion  $[\text{Cr}(\text{NH}_3)\text{Cl}_3(\text{OH})_2]^{2-}$  ?  
 (1) 2 (2) 3 (3) 4 (4) 5
12. Which of the following ions are optically active?
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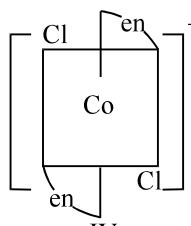
I



II



III



IV
- (1) I only (2) II only (3) II and III (4) IV only

## DPP-06 Organometallic Compounds

1. Which of the following statement is correct with respect to the metal carbonyls of I<sup>st</sup> transition series?  
 (1) As  $\text{M} - \text{C}\pi$  bonding increases, the  $\text{C} - \text{O}$  bond length increases.  
 (2) As positive charge on the central metal atom increases, the  $\text{C} - \text{O}$  bond length increases.  
 (3) As electron density on the central metal atom increases, the  $\text{C} - \text{O}$  bond length increases.  
 (4) (1) and (3) both.
2. Which amongst the following are organometallic compounds ?  
 1.  $\text{Al}_2(\text{CH}_3)_6$  2.  $\text{K}[\text{PtCl}_3\text{C}_2\text{H}_2]$  3.  $\text{N}(\text{CH}_3)_3$   
 (1) 1 only (2) 3 only (3) 1 and 2 only (4) 1, 2 and 3

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**ANSWER KEY**

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**DPP-01**

1. (4) 2. (4) 3. (2) 4. (3) 5. (3) 6. (1) 7. (2)  
8. (2) 9. (1) 10. (3) 11. (3) 12. (1) 13. (2) 14. (3)

**DPP-02**

1. (3) 2. (3) 3. (3) 4. (2) 5. (2) 6. (2)  
7. (1) 8. (2) 19. (2)

**DPP-03**

1. (1) 2. (2) 3. (1) 4. (1) 5. (3) 6. (2) 7. (3)  
8. (2) 9. (2) 10. (3) 11. (3) 12. (2) 13. (3) 14. (1)

**DPP-04**

1. (4) 2. (4) 3. (2) 4. (4) 5. (3) 6. (1) 7. (4)  
8. (1) 9. (4) 10. (2) 11. (1) 12. (3) 13. (4)

**DPP-05**

1. (4) 2. (1) 3. (1) 4. (4) 5. (3) 6. (4) 7. (4)  
8. (4) 9. (3) 10. (2) 11. (2) 12. (3)

**DPP-06**

1. (4) 2. (3)

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