BITSAT Chemistry Answer Key 2022

Question 31

Which one of the following is correct order of given isotopes?
I. $T_2 > D_2 > P_2$ (order of boiling point)
II. $T_2 > D_2 > P_2$ (order of bond energy)
III. $T_2 = D_2 = P_2$ (order of bond length)
IV. $T_2 < D_2 < P_2$ (order of reactivity with Cl_2)

Options:

A. I and II

B. III and IV

C. II, III and IV

D. All of these

Answer: D

Solution:

Solution:
Protium (P), deuterium (D) and tritium (T) are the three isotopes of hydrogen. These isotopes follow the order in different contexts as shown below :
$T_2 > D_2 > P_2$ [Order of boiling point (BP)]
$T_2 > D_2 > P_2$ [Order of bond energy (BE)]
$T_2 = D_2 = P_2$ [Order of bond length (BL)]
$T_2 Hence, all the given order are correct.

Question 32

Ninhydrin gives yellow colour in paper chromatography with which amino acid?

Options:

A. Tryptophan

B. Proline

C. Alanine

D. Tyrosine

Answer: B

Solution:

Solution:
The amino acid which gives yellow colour with ninhydrin in paper chromatography is proline.
Ninhydrin + Proline → Yellow-orange product

Question 33

How will raise in temperature affects the viscosity of liquids and gases?

Options:

A. Both increases

B. Both decreases

C. In case of liquids, decreases and in case of gases, increases.

D. In case of liquid, increases and in case of gases, decreases.

Answer: B

Solution:

Solution:
In case of liquids, cohesive forces decrease and hence, their viscosity decreases while increasing the temperature. However, in case of gases, with the increase in temperature kinetic energy of gaseous molecules increases and the molecules become more mobile.

Question 34

Which of the following compounds is thermodynamically is the most stable?

Options:

A. $BaCO_3$

B. $MgCO_3$

C. $SrCO_3$

D. $CaCO_3$

Answer: A

Solution:

Solution:
The thermal stability of carbonates increases down the group. So, the order of thermal stability of carbonates of alkaline earth metals is
$BaCO_3$ > $CaCO_3$ > M gCO_3 > $BeCO_3$.
Therefore, $BaCO_3$ is thermodynamically most stable and $BeCO_3$ is least stable.

Question 35

Glucose reacts with X number of molecules of phenyl hydrazine to yield osazone. The value of X is,

Options:

A. three

B. two

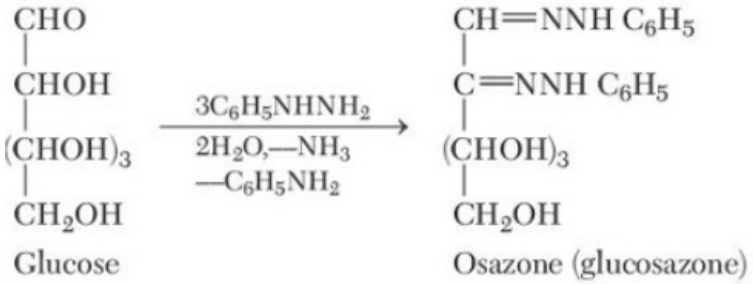
C. one

D. four

Answer: A

Solution:

Solution:



Hence, three molecules of phenyl hudrazine (C_6H_5NHNH_2) is used to yield osazone.

Question 36

Nylon- 6,6 is obtained from

Options:

A. adipic acid and hexamethylene diamine

B. tetrafluoroethylene

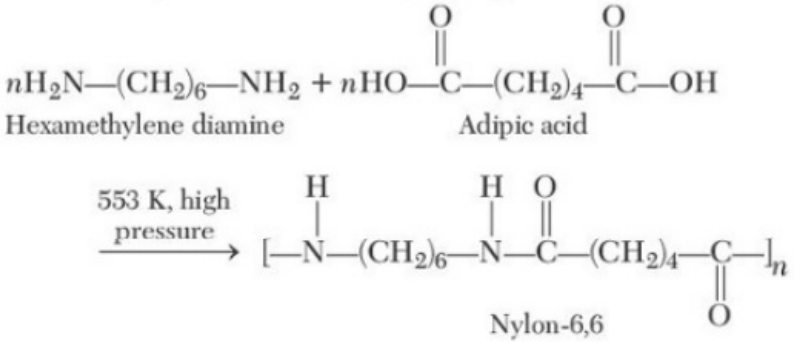
C. vinyl cyanide

D. vinyl benzene

Answer: A

Solution:

Solution:
The monomer units of nylon -6, 6 are hexamethylene diamine and adipic acid.



Question 37

What is the hybridisation of $[CrF_6]^{3-}$?

Options:

A. sp^3d

B. sp^3d^2

C. d^2sp^3

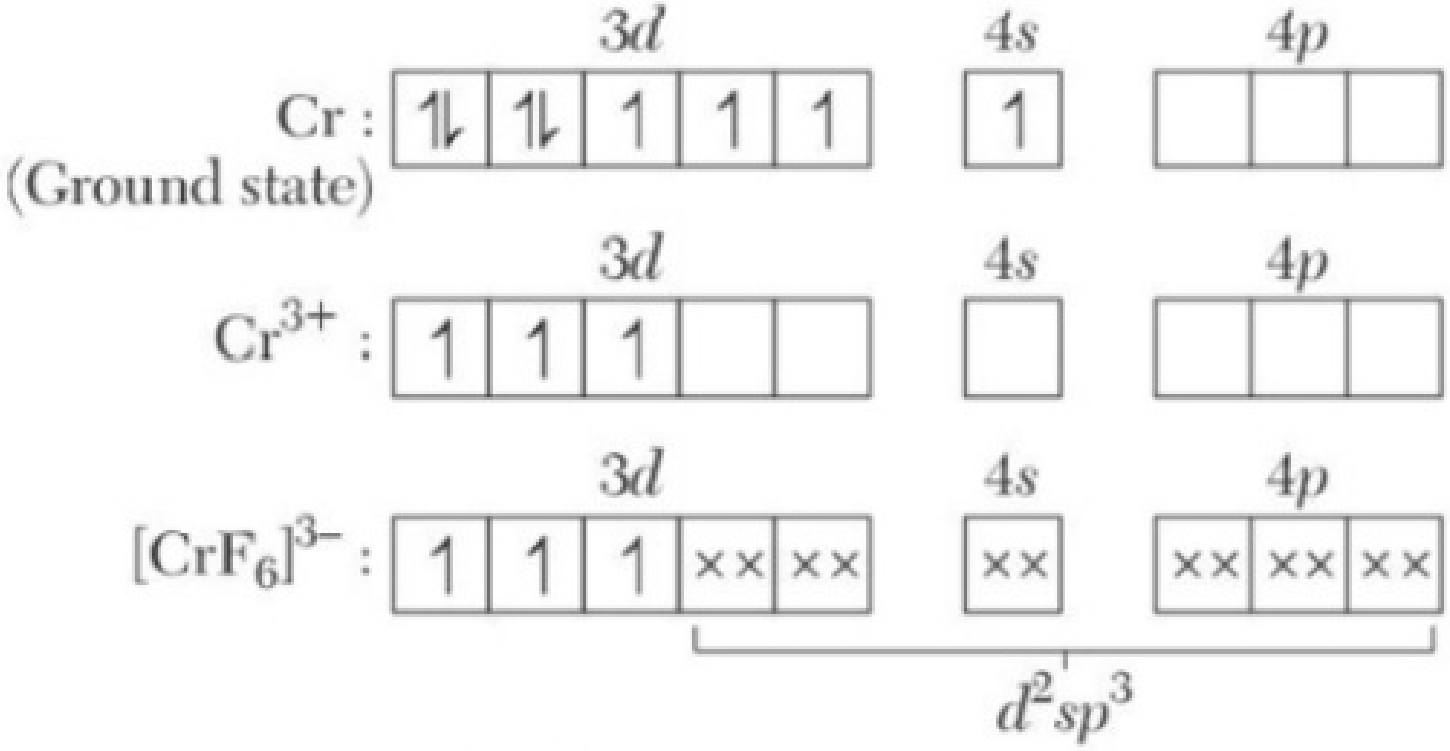
D. d^2sp

Answer: C

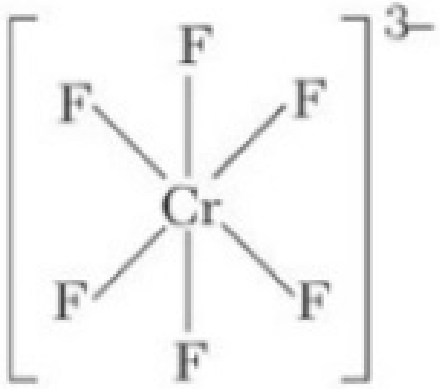
Solution:

Solution:

The electronic configuration of Cr is $[Ar]3d^5 4s^1$.



$[CrF_6]^{3-}$ has d^2sp^3 - hybridization and octahedral geometry.



Question 38

OF and F_2 can be compared in terms of

Options:

A. OF is paramagnetic while F_2 is diamagnetic

B. OF is more stable towards dissociation into atoms

C. Both (a) and (b) are correct

D. None of the above is correct

Answer: C

Solution:

Solution:

Species	Electons	Bond order	Unpaired electron	
$O-F$	17	1.5	1	Paramegnetic
F_2	18	1.0	0	Diamagnetic

This is one unpaired electron on $(O-F)$, hence paramagnetic, thus (a) is correct.
As bond order of $O-F > F-F$ thus, bond energy of $O-F > F-F$.
Hence, (a) and (b) both correct.

Question 39

ortho and para form of hydrogen have

Options:

A. different physical and chemical properties

B. identical physical properties but different chemical properties

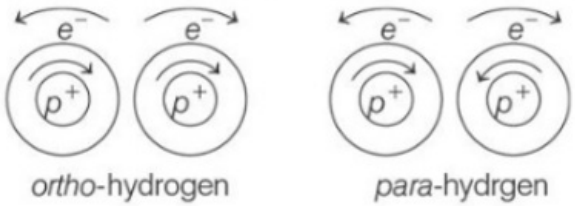
C. identical chemical properties but different physical properties

D. identical chemical and physical properties

Answer: C

Solution:

Solution:
ortho and para hydrogen similar to each other in their chemical properties but they have different physical properties like boiling point, thermal conductivity, due to their difference in overall spins.



Question 40

The structure of H_2O_2 is

Options:

A. planar, linear

B. non-planar, linear

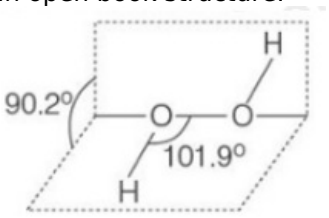
C. planar, non-linear

D. non-planar, non-linear

Answer: D

Solution:

Solution:
Hydrogen peroxide (H_2O_2) is a non-planar molecule with twisted symmetrical structure. It has non-linear structure with an open book structure.



Question 41

Match the species in Column I with their types in Column II.

Column I	Column II
A. DDT	1. Photochemical smog
B. $NaClO_3$	2. Disinfectant
C. Cl_2	3. Herbicides
D. PAN	4. Pesticides

Options:

A. A → 4, B → 3, C → 2, D → 1

B. A → 1, B → 2, C → 3, D → 1

C. A → 2, B → 3, C → 1, D → 4

D. A → 3, B → 1, C → 2, D → 4

Answer: A

Solution:

Solution:
The correct match is
A → (4); B → (3); C → (2); D → (1)
A. DDT → Pesticides
B. $NaClO_3$ → Herbicides
C. Cl_2 → Disinfectants
D. PAN → Photochemical smog

Question 42

In which pair or pairs is the stronger bond found in the first species?
I. O_2^{2-}, O_2;
II. N_2, N_2^+; III. NO^+, NO^-

Options:

A. I only

B. II only

C. I and II only

D. II and III only

Answer: D

Solution:

Solution:

	Bond order		
I.	O_2^{2-} O_2	1 1	Weaker
II.	N_2 N_2^+	3 2.5	Stronger
III.	NO^+ NO^-	3 2	Stronger

Larger the bond order, stronger the bond formed.

Question 43

Select the correct statement about the complex $[Co(NH_3)_5SO_4]Br$.

Options:

A. Its ionisation isomer is $[Co(NH_3)_5Br]SO_4$.

B. It gives yellow precipitate with $AgNO_3$.

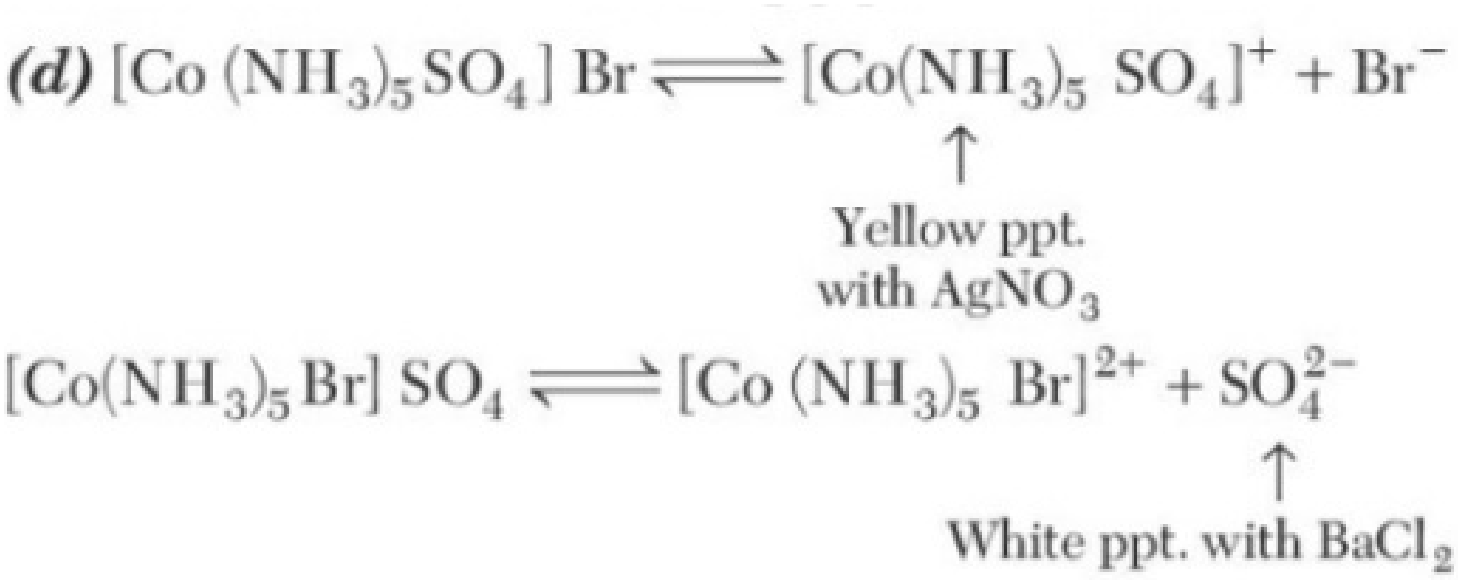
C. Its ionisation isomer give while precipitate with $BaCl_2$.

D. All the above are correct statements.

Answer: D

Solution:

Solution:



Question 44

A certain metal sulphide, MS_2, is used extensively as a high temperature lubricant. If MS_2 is 40.06% by mass sulphur, metal M has atomic mass.

Options:

A. 160 u

B. 64 u

C. 40u

D. 96u

Answer: D

Solution:

Solution:
$MS - 2 = M + 32 \times 2 = M + 64$

$\%$ of sulphur $= \left(\frac{64}{M + 64}\right) \times 100 = 40.06$

$M + 64 = \frac{6400}{40.06}$

$M + 64 = 160$

$M = 160 - 64 = 96u$

Question 45

X $\xrightarrow[\text{Boiling}^2]{Cl}$ Benzotrichloride $\xrightarrow{H_3O^+}$ Y
X and Y are

Options:

A. benzene, benzaldehyde

B. toluene, benzaldehyde

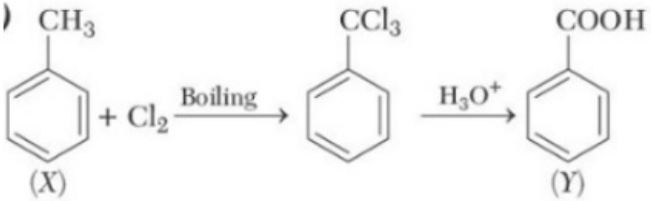
C. toluene, benzoic acid

D. benzene, benzoic acid

Answer: C

Solution:

Solution:



Question 46

Ge (II) compounds are powerful reducing agents whereas Pb (IV) compounds are strong oxidants. It can be because

Options:

A. Pb is more electropositive than G

B. ionisation potential of lead is less than that of Ge.

C. ionic radii of Pb^{2+} and Pb^{4+} are larger than that of Ge^{2+} and Ge^{4+}.

D. more pronounced inert pair effect in lead has.

Answer: D

Solution:

Solution:
Inert pair effect is more pronounced in heavier members like Pb.
Hence, Pb (IV) compounds act as strong oxidising agents and are reduced to more stable Pb (II) compounds.

Question 47

Which compound has antifluorite structure?

Options:

A. MnO_4

B. Na_2O

C. Na_2O_2

D. Li_2O_2

Answer: B

Solution:

Solution:
Anti-fluorite structure refers to an anion array with tetrahedral cations and the compound having A_2B formula have anti-fluorite structure. So, Na_2O has an anti-fluorite structure in which Na^+ ions occupy all the tetrahedral voids and O^{2-} occupy half of the cubic holes.

Question 48

100 mL of 2M of formic acid(pK_a = 3.74) is neutralise by NaOH, at the equivalence point pH is

Options:

A. 7

B. 6

C. 9.5

D. 8.87

Answer: D

Solution:

Solution:
Sodium formate is present at the equivalence point. It is the salt of weak acid + strong base. So, final solution will be basic in nature.
As we know

$$pH = 7 + \frac{pK_a}{2} + \frac{\log C}{2}$$

where, C is concentration of salt.
Total volume of solution = 100 + 100 = 200mL

Concentration of salt (C) = $2 \times \frac{100}{200} = 1M$

$$pH = 7 + \frac{3.74}{2} + \frac{\log[1]}{2}$$

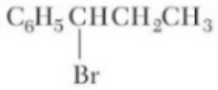
$pH = 7 + 1.87 + 0$
$pH = 8.87$

Question 49

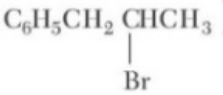
The reaction of $C_6H_5CH = CHCH_3$ with HBr produces

Options:

A.

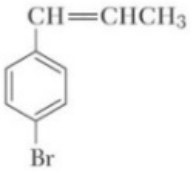


B.



C. $C_6H_5CH_2CH_2Br$

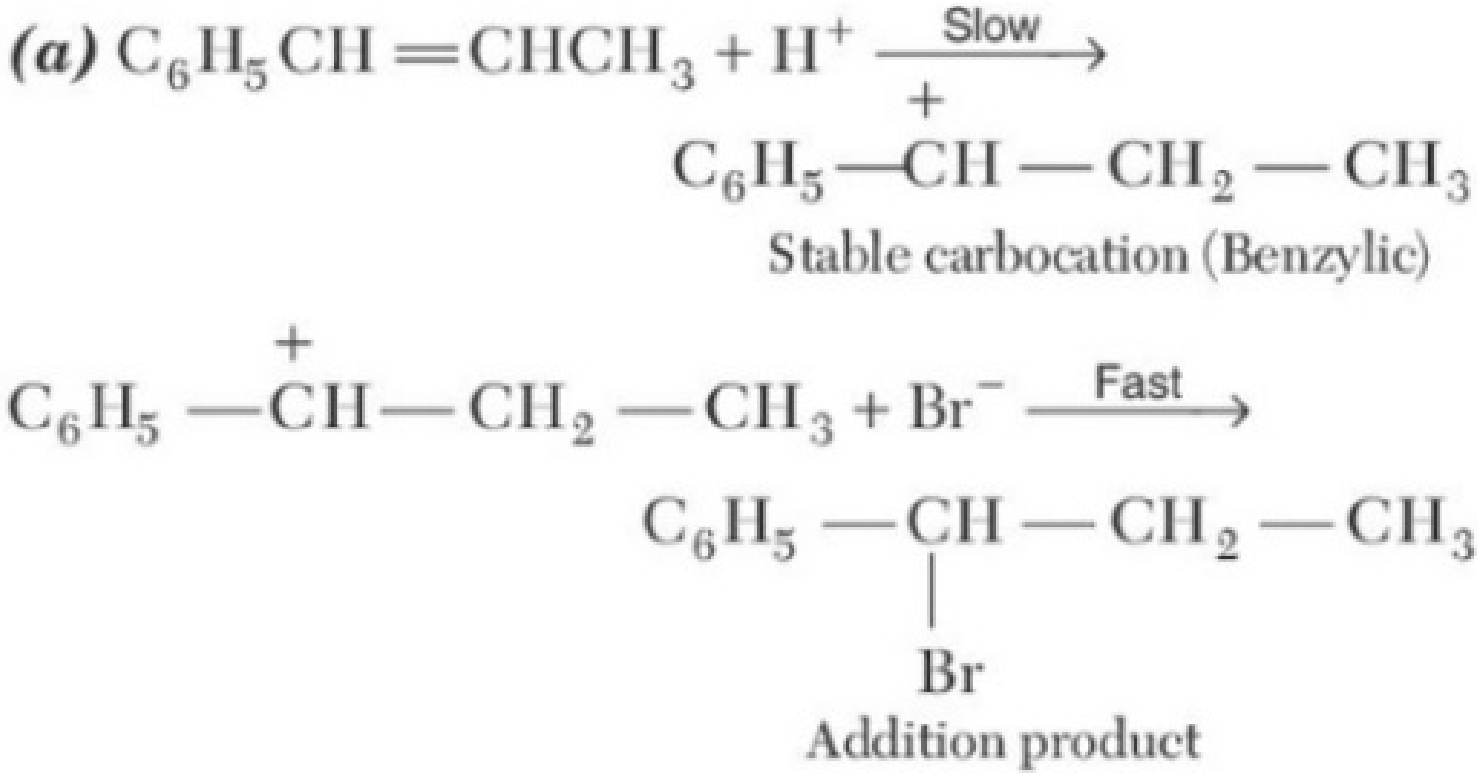
D.



Answer: A

Solution:

Solution:



Electrophile addition reaction takes place via more stable carbocation.

Question 50

The number of 3C − 2e⁻bonds present in diborane is

Options:

A. 1

B. 2

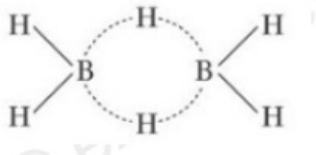
C. 3

D. 4

Answer: C

Solution:

Solution:
The structure of diborane is



In this structure, there are two $3C-2e^{-}$bonds. 3 atoms, $B-H-B$ share two electrons and form an angular geometry, leading bent bond, also known as banana bond.

Question 51

Standard entropy of X_2, Y_2 and XY_2 are 60,40 and 50$JK^{-1}mol^{-1}$, respectively. For the reaction, $\frac{1}{2}X_2 + \frac{3}{2}Y_2 \rightarrow XY_3$, $\Delta H = -30\,kJ$, to be at equilibrium, the temperature will be

Options:

A. 1250K

B. 500K

C. 750K

D. 1000K

Answer: C

Solution:

Solution:
$\Delta S = S(XY_3) - \frac{1}{2}S(X_2) - \frac{3}{2}S(Y_2)$
$= 50 - 30 - 60 = -40 J\,mol^{-1}K^{-1}$
$\Delta H = -30kJ = -3000J$
$\Delta G = \Delta H - T\Delta S$
At equilibrium,
$\Delta G = 0$
$T = \frac{\Delta H}{\Delta S} = \frac{-3000}{-40} = 750K$

Question 52

The total number of $P-OH$ bonds for pyrophosphoric acid

Options:

A. 4

B. 5

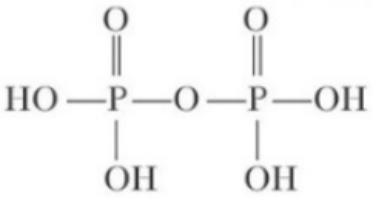
C. 6

D. 8

Answer: A

Solution:

Solution:
The structure of pyrophosphoric acid is



There are $P-OH$ bonds, $1P-O-P$ bond and two $P=O$ bonds.

Question 53

Using the standard electrode potential, find out the pair between which redox reaction is not feasible. $E^{\ominus}$ values
Fe^{3+} / Fe^{2+} = +0.77; I_2 / I^- = +0.54
Cu^{2+} / Cu = +0.34; Ag^+ / Ag = 0.80V

Options:

A. Fe^{3+} and I^-

B. $Ag^+$and Cu

C. Fe^{3+} and Cu

D. Ag and Fe^{3+}

Answer: D

Solution:

Solution:
(a) $2F\,e^{3+} + 2e^- \rightarrow 2F\,e^{2+}$; $E^\circ = 0.77V$
$2I^- \rightarrow I_2 + 2e^-$; $E^\circ = -0.54V$ (sign of E° is reversed)

$2F\,e^{3+} + 2I^- \rightarrow 2F\,e^{2+} + I_2$; $E^\circ_{cel} = +0.23V$

This reaction is feasible, since E°_{cell} is positive.
(b) $Cu \rightarrow Cu^{2+} + 2e^-$; $E^\circ = -0.34V$ (sign of E° gas been reversed)
$2Ag^+ + 2e^- \rightarrow 2Ag$; $E^\circ = +0.80V$

$Cu + 2AG^+ \rightarrow Cu^{2+} + 2Ag$; $E^\circ = +0.46V$