JEE Mains 2019 Chapter wise Question Bank

Metallurgy - Questions

Q1

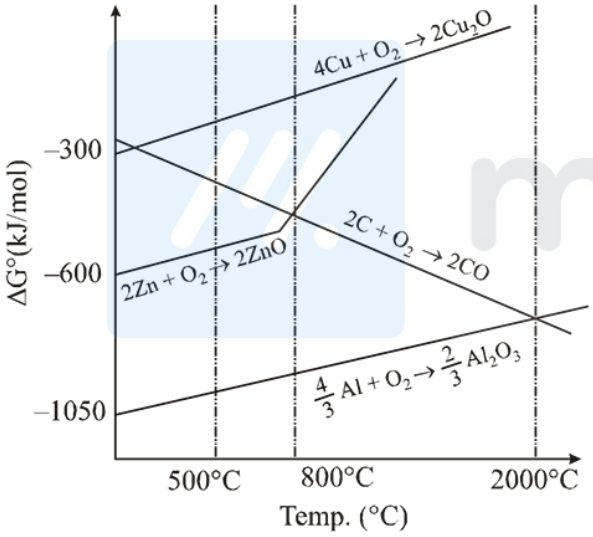
The ore that contains both iron and copper is:

(1) copper pyrites (2) malachite
(3) dolomite (4) azurite

9 Jan Morning

Q2

The correct statement regarding the given Ellingham diagram is:



(1) At 1400°C, Al can be used for the extraction of Zn from ZnO
(2) At 500°C, coke can be used for the extraction of Zn from ZnO
(3) Coke cannot be used for the extraction of Cu from Cu_2O.
(4) At 800°C, Cu can be used for the extraction of Zn from ZnO

9 Jan Evening

Q3

Hall-Heroult's process is given by:

(1) $Cu^{2+}(aq) + H_2(g) \rightarrow Cu(s) + 2H^+(aq)$
(2) $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$
(3) $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$
(4) $ZnO + C \xrightarrow{\text{Coke, 1673 K}} Zn + CO$

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Q4

Match the ores **(column A)** with the metals **(column B)** :

	(Column A) Ores		**(Column B) Metals**
(I)	Siderite	(a)	Zinc
(II)	Kaolinite	(b)	Copper
(III)	Malachite	(c)	Iron
(IV)	Calamine	(d)	Aluminium

(1) (I) - (a); (II) - (b); (III) - (c); (IV) - (d)
(2) (I) - (c); (II) - (d); (III) - (b); (IV) - (a)
(3) (I) - (c); (II) - (d); (III) - (a); (IV) - (b)
(4) (I) - (b); (II) - (c); (III) - (d); (IV) - (a)

11 Jan Morning

Q5

The reaction that does NOT define calcination is:

(1) $Fe_2O_3.xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$
(2) $2Cu_2S + 3O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2$
(3) $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$
(4) $CaCO_3.MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$

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Q6

Match the following items in **column I** with the corresponding items in **column II**.

	Column-I		**Column-II**
(i)	$Na_2CO_3.10H_2O$	(A)	Portland cement ingredient
(ii)	$Mg(HCO_3)_2$	(B)	Castner-Kellner process
(iii)	NaOH	(C)	Solvay process
(iv)	$Ca_3Al_2O_6$	(D)	Temporary hardness

(1) (i) → (B); (ii) → (C); (iii) → (A); (iv) → (D)
(2) (i) → (C); (ii) → (B); (iii) → (D); (iv) → (A)
(3) (i) → (D); (ii) → (A); (iii) → (B); (iv) → (C)
(4) (i) → (C); (ii) → (D); (iii) → (B); (iv) → (A)

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Q7

In the Hall-Heroult process, aluminium is formed at the cathode. The cathode is made out of:

(1) Pure aluminium (2) Carbon
(3) Copper (4) Platinum

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Q8

The pair that does NOT require calcination is :

(1) ZnO and MgO (2) ZnO and $Fe_2O_3 \cdot xH_2O$
(3) $ZnCO_3$ and CaO (4) Fe_2O_3 and $CaCO_3 \cdot MgCO_3$

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Q9

With respect to an ore, Ellingham diagram helps to predict the feasibility of its

(1) Electrolysis (2) Zone refining
(3) Vapour phase refining (4) Thermal reduction

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Q10

The Mond process is used for the :

(1) purification of Ni
(2) extraction of Mo
(3) purification of Zr and Ti
(4) extraction of Zn

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Q11

The ore that contains the metal in the form of fluoride is:

(1) cryolite (2) malachite
(3) magnetite (4) sphalerite

9 April Morning

Q12

Assertion: For the extraction of iron, haematite ore is used.

Reason: Haematite is a carbonate ore of iron.

(1) Only the reason is correct
(2) Both the assertion and reason are correct, but the reason is not the correct explanation for the assertion.
(3) Both the assertion and reason are correct and the reason is the correct explanation for the assertion.
(4) Only the assertion is correct.

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Q13

The one that is not a carbonate ore is:

(1) malachite (2) calamine
(3) siderite (4) bauxite

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Q14

Match the refining methods **(Column I)** with metals **(Column II)**.

Column I (Refining methods)	**Column II (Metals)**
(I) Liquation	(a) Zr
(II) Zone Refining	(b) Ni
(III) Mond Process	(c) Sn
(IV) Van Arkel Method	(d) Ga

(1) (I) – (c); (II) – (a); (III) – (b); (IV) – (d)
(2) (I) – (b); (II) – (c); (III) – (d); (IV) – (a)
(3) (I) – (c); (II) – (d); (III) – (b); (IV) – (a)
(4) (I) – (b); (II) – (d); (III) – (a)l (IV) – (c)

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Q15

The alloy used in the construction of aircrafts is :

(1) Mg – Al (2) Mg – Zn
(3) Mg – Sn (4) Mg – Mn

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Q16

The correct statement is :

(1) aniline is a froth stabilizer.
(2) zincite is a carbonate ore.
(3) sodium cyanide cannot be used in the metallurgy of silver.
(4) zone refining process is used for the refining of titanium.

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Q17

The idea of froth floatation method came from a person X and this method is related to the process Y of ores, X and Y, respectively, are :

(1) fisher woman and concentration
(2) washer woman and concentration
(3) fisher man and reduction
(4) washer man and reduction

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Q18

The correct statement is :

(1) leaching of bauxite using concentrated NaOH solution gives sodium aluminate and sodium silicate.
(2) the Hall-Heroult process is used for the production of aluminium and iron.
(3) pig iron is obtained from cast iron.
(4) the blistered appearance of copper during the metallurgical process is due to the evolution of CO_2.

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Metallurgy - Answers

Q1

(1) Amongst the given ores, copper pyrite ($CuFeS_2$), dolomite ($MgCO_3.CaCO_3$), malachite [$CuCO_3.Cu(OH)_2$], azurite [$2CuCO_3.Cu(OH)_2$], copper pyrite contains both copper and iron.

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Q2

(1) In the given Ellingham diagram, the metal which has a lower value of $\Delta G°$ (more negative) can reduce a metal oxide whose curve lies above it. So, Al can reduce ZnO at 1400 °C.

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Q3

(3) Hall Heroult's process is an electrochemical process used in extraction of Al from alumina.

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Q4

(2) Siderite = $FeCO_3$
Calamine = $ZnCO_3$
Malachite = $CuCO_3.Cu(OH)_2$
Kaolinite = $Al_2Si_2O_5(OH)_4$

11 Jan Morning

Q5

(2) Calcination involves heating of carbonates or hydrated oxides in absence of air.

$\therefore\ 2Cu_2S + 3O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2$; is roasting (heating in a regular supply of air).

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Q6

(4) (i) $Na_2CO_3.10H_2O \rightarrow$ Solvay process
(ii) $Mg(HCO_3)_2 \rightarrow$ Temporary hardness
(iii) $NaOH \rightarrow$ Castner-Kellner process
(iv) $Ca_3Al_2O_6 \rightarrow$ Portland cement

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Q7

(2) In Hall-Heroult process, steel vessel with lining of carbon acts as cathode and graphite is used as anode.

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Q8

(1) Calcination involves the conversion of metal carbonates or hydrated oxides into metal oxides. ZnO and MgO are oxides, therefore, does not require calcination.

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Q9

(4) Ellingham diagram is a graph showing the temperature dependence of the stability for compounds. It is used to select reducing agent so it helps to predict feasibility of its thermal reduction.

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Q10

(1) Mond's process is used for purification of Ni

$$\underset{\text{(impure)}}{\text{Ni}} + 4CO \xrightarrow{330-350\ K} Ni(CO)_4$$

$$Ni(CO)_4 \xrightarrow{450-470\ K} \underset{\text{(pure)}}{\text{Ni}} + 4CO\uparrow$$

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Q11

(1)

Magnetite	Fe_3O_4
Sphalerite	ZnS
Cryolite	Na_3AlF_6
Malachite	$CuCO_3.Cu(OH)_2$

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Q12

(4) For the extraction of iron, haematite ore (Fe_2O_3) is used

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Q13

(4) Bauxite $\rightarrow$ $Al(OH)_3$
Calamine $\rightarrow$ $ZnCO_3$
Siderite $\rightarrow$ $FeCO_3$
Malachite $\rightarrow$ $CuCO_3 \cdot Cu(OH)_2$

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Q14

(3) Liquation is used for Sn, zone refining is used for Ga, mond's process is used for refining of Ni and van Arkel method is used for Zr,
So, correct match is
(I) - (c); (II)-(d); (III)-(b); (IV)-(a)

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Q15

(1) In manufacturing of aircraft an alloy of Mg and Al called magnalium is used due to its light weight and high strength.

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Q16

(1) Ti is refined by van Arkel method. Silver is leached by dilute solution of NaCN. Zincite is oxide ore of zinc i.e. ZnO. Aniline is a froth stabilizer.

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Q17

(2) Froth floatation was discovered by washer women. It is a method of concentration of ores.

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Q18

(1) During metallurgy of aluminium, when bauxite (powdered ore) is treated with NaOH (conc), sodium aluminate ($Na[Al(OH)_4]$) is formed and impurity (SiO_2) present in bauxite dissolves by forming sodium silicate (Na_2SiO_3)

$$Al_2O_3(s) + 2NaOH(aq) + 3H_3O(l) \rightarrow 2Na[Al(OH)_4](aq)$$

Cast iron is obtained from pig iron.
Blister of copper is due to evolution of SO_2.
Hall Heroult process is used for the production of aluminium.

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