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Process engineering department قسم هندسة الطرائق

2nd year Process Engineering – Mineral Chemistry مقياس: الكيمياء المعدنية

***First Exam***

***Exercise 1 (8 points):***

***01/*** In the 3D crystal lattice with lattice parameters *a*, *b*, *c*, Draw the crystallographic planes: (each correct answer 1point)

01 / أرسم المستويات البلورية التالية

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **(110)** | **1)** | **(011)** | **(33)** |

***02/*** In the 3D crystal lattice with lattice parameters *a*, *b*, *c*, the crystallographic planes are drawn, Provide the Miller indices for the following planes: (each correct answer 1point)

02/ أعط مؤشرات ميلر في الحالات التالية

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **(110)** | **(012)** | **(00)** | **(22)** |

***Exercise 2 (8 points):***

**1. The equation of the reaction:**

2NH3​(*g*)+3CuO(*s*)→3Cu(*s*)+3H2​O(*g*)+N2​(*g*) (1pnt)

**2. The limiting reactant:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 2NH3​(*g*) +3CuO(*s*) →3Cu(*s*) +3H2​O(*g*)+ N2​(*g*) | | | |
| **t=0** | **n0,NH3** | **n0,cuo** | **0** | **0** |
| **T** | **n0,NH3 -2x** | **n0,cuo-3x** | **3x** | **x** |
| **tmax** | **n0,NH3 -2xmax (0,25)** | **n0,cuo-3xmax (0,25)** | **3xmax (0,25)** | **xmax (0,25)** |

The limitant reactant is CuO

3. **Molar volume of N₂ obtained in standard conditions:**

* + Molar volume of any gas at STP = **22.4 L/mol (0,5)**

4. **The percentage conversion of each reactant.**

The mass of Cu produced is 59, 32 g

*(0,5)*

**5. The yield of the reaction**:

***Exercise 3 (4points):***

What’s the correct answer? (each correct answer 0,5point)

1. Which group of elements is known as the "alkali metals"? ماهي مجموعة المعادن القلوية

|  |  |  |  |
| --- | --- | --- | --- |
| * IA | * IIA | * IIA | * IVA |

1. Which of the following elements is a metalloid? من بين هذه العناصر من هو شبيه المعدن

|  |  |  |  |
| --- | --- | --- | --- |
| * Sodium (Na) | * Boron (B) | * Oxygen (O) | * Fluorine (F) |

1. What is the oxidation state of fluorine in most of its compounds? ماهي درجة اكسدة الفلور في أغلب مركباته

|  |  |  |  |
| --- | --- | --- | --- |
| * +1 | * -1 | * +2 | * -2 |

1. What is the primary use of hypochlorite (NaClO)? ماهي الفائدة الأولى من استعمال الهيبوكلوريت

|  |  |  |  |
| --- | --- | --- | --- |
| * As a coolant كغراء | * As a disinfectant * كمعقم | * As a semiconductor كشبيه موصل | * As a fertilizer كسماد |

1. What is the primary reason alkali metals are stored in oil? ماهو السبب الرئيسي من خزين المعادن القلوية في الزيوت

|  |  |  |  |
| --- | --- | --- | --- |
| * To prevent them from melting   لمنع الذوبان | * To avoid violent reactions with air or water لمنع تفاعلها مع الهواء أو الماء | * To enhance their electrical conductivity * لتحسين ناقليتها | * To increase their density   لزيادة كثافتها |

1. What is the trend in electronegativity as you move from top to bottom in a group? كيف تتغير الكهروسلبية كلما انتقلنا من الأعلى الى الأسفل في المجموعة

|  |  |  |
| --- | --- | --- |
| * Electronegativity increases.تزداد | * Electronegativity decreases.تنقص | * Electronegativity remains constant. ثابتة |

1. What is the general trend in atomic radius as you move from left to right across a period in the periodic table? كيف يتغير القطر الذري للعناصر اذا انتقلتا من اليسار الى اليمين في الدور او السطر

|  |  |  |
| --- | --- | --- |
| * Atomic radius decreases.ينقص | * Atomic radius increases.يزيد | * Atomic radius remains constant.ثابت |

1. Which rule describes the periodic table's filling order of electron sublevels (s, p, d, f)?

ماهي قاعدة ملأ الإلكترونات في المدارات (s, p, d, f)

|  |  |  |
| --- | --- | --- |
| * Hund's rule | * Pauli exclusion principle | * Klechkowski rule |

Good luck