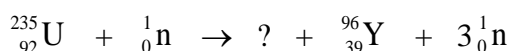


1. What is the electronic configuration of Cr^{2+} ?

- a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$
- b) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$
- c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$
- d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$
- e) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^3$

2. Which nuclide is needed to balance the following nuclear reaction?



- a) ${}_{53}^{139}\text{I}$
- b) ${}_{53}^{138}\text{I}$
- c) ${}_{53}^{137}\text{I}$
- d) ${}_{53}^{136}\text{I}$
- e) ${}_{53}^{135}\text{I}$

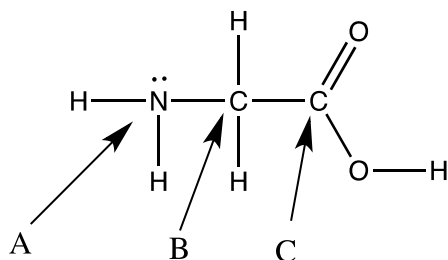
3. Which of the following electron excitations of the hydrogen atom requires light of the *shortest* wavelength?

- a) $n = 2$ to $n = 3$
- b) $n = 3$ to $n = 4$
- c) $n = 4$ to $n = 20$
- d) $n = 5$ to $n = 100$
- e) $n = 4$ to $n = 1000$

4. Which one of the following sets of quantum numbers is valid?

- | | n | l | m_l | m_s |
|----|-----|-----|-------|----------------|
| a) | 3 | 1 | 0 | 0 |
| b) | 1 | 1 | 0 | $-\frac{1}{2}$ |
| c) | 3 | 3 | -2 | $+\frac{1}{2}$ |
| d) | 1 | 1 | 1 | 0 |
| e) | 5 | 4 | 3 | $+\frac{1}{2}$ |

5. What is the hybridization of the atoms indicated in the following molecule.



- a) A = sp^2 B = sp^2 C = sp^2
- b) A = sp^2 B = sp^3 C = sp^2
- c) A = sp^3 B = sp^2 C = sp
- d) A = sp^3 B = sp^3 C = sp^2
- e) A = sp^3 B = sp^2 C = sp^2

6. The thermal decomposition of potassium chlorate is a convenient preparation for small amounts of oxygen gas in the laboratory. The reaction is:



What mass of potassium chlorate would produce a theoretical yield of 10.00 g of oxygen?

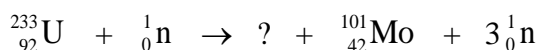
- a) 25.5 g b) 30.4 g c) 38.3 g d) 51.1 g e) 57.5 g
7. What amount (in mol) of $\text{AlPO}_4(\text{s})$ precipitates when 0.060 M aluminium nitrate solution (100 mL) is added to 0.080 M potassium phosphate solution (50 mL)?
- a) 0.0060
b) 0.0060
c) 0.0040
d) 0.0020
e) 0.040
8. Place the following atoms in order of increasing atomic radius: Al, O, P, Cl, Ne
- a) $\text{O} < \text{Ne} < \text{Al} < \text{P} < \text{Cl}$
b) $\text{Ne} < \text{Cl} < \text{O} < \text{P} < \text{Al}$
c) $\text{Ne} < \text{O} < \text{Cl} < \text{P} < \text{Al}$
d) $\text{O} < \text{Ne} < \text{Cl} < \text{P} < \text{Al}$
e) $\text{Al} < \text{P} < \text{O} < \text{Cl} < \text{Ne}$
9. What is the molecular geometry of the SO_4^{2-} ion?
- a) trigonal planar
b) trigonal bipyramidal
c) octahedral
d) tetrahedral
e) T-shaped
10. Which of the following is **not** an example of a conjugate acid-base pair?
- a) HCN, CN^-
b) $\text{H}_3\text{PO}_4, \text{PO}_4^{3-}$
c) $\text{HClO}_3, \text{ClO}_3^-$
d) $\text{H}_3\text{O}^+, \text{H}_2\text{O}$
e) $\text{HCO}_3^-, \text{CO}_3^{2-}$

Correct answers: 1D, 2C, 3A, 4E, 5D, 6A, 7C, 8C, 9D, 10B

1. What is the electronic configuration of Mn^{4+} ?

- a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$
 b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^2$
 c) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$
 d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$
 e) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$

2. Which nuclide is needed to balance the following nuclear reaction?



- a) ${}_{50}^{132}\text{Sn}$ b) ${}_{50}^{131}\text{Sn}$ c) ${}_{50}^{130}\text{Sn}$ d) ${}_{50}^{129}\text{Sn}$ e) ${}_{50}^{128}\text{Sn}$

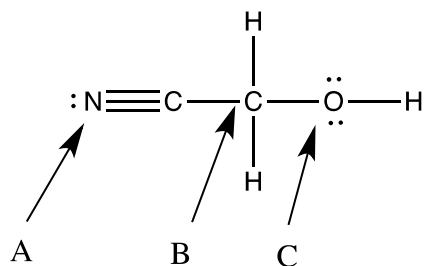
3. Which of the following electron excitations of the hydrogen atom requires light of the *longest* wavelength?

- a) $n = 2$ to $n = 3$
 b) $n = 3$ to $n = 4$
 c) $n = 4$ to $n = 20$
 d) $n = 5$ to $n = 100$
 e) $n = 4$ to $n = 1000$

4. Which one of the following sets of quantum numbers is valid?

- | | n | l | m_l | m_s |
|----|-----|-----|-------|----------------|
| a) | 4 | 4 | 3 | $+\frac{1}{2}$ |
| b) | 2 | 1 | 0 | $-\frac{1}{2}$ |
| c) | 3 | 2 | -2 | +1 |
| d) | 1 | 1 | 1 | 0 |
| e) | 3 | 1 | 0 | 0 |

5. What is the hybridization of the atoms indicated in the following molecule.



- A. A = sp B = sp^3 C = sp^2
 B. A = sp B = sp^3 C = sp^3
 C. A = sp^2 B = sp^3 C = sp^2
 D. A = sp^2 B = sp^3 C = sp^3
 E. A = sp^3 B = sp^2 C = sp^3

6. Hydrogen bromide reacts with manganese dioxide according to the following equation.



What mass of bromine can be produced from 6.5 g of hydrogen bromide?

- a) 12.8 g b) 6.42 g c) 3.21 g d) 1.60 g e) 0.802 g

7. What amount (in mol) of $\text{Cr}_2\text{S}_3(\text{s})$ precipitates when 0.040 M chromium(III) chloride solution (100 mL) is added to 0.030 M sodium sulfide solution (50 mL)?

- a) 0.0005
b) 0.0015
c) 0.0020
d) 0.0030
e) 0.0045

8. In which of the following are the atoms arranged in order of INCREASING first ionisation energy?

- a) Ne, F, O, C
b) Te, Se, S, O
c) Ca, K, Cl, Ar
d) He, Ne, Ar, Kr
e) N, P, K, Rb

9. What is the molecular geometry of the BeF_2 molecule?

- a) trigonal planar
b) tetrahedral
c) trigonal pyramidal
d) T-shaped
e) linear

10. Which of the following is **not** an example of a conjugate acid-base pair?

- a) HSO_3^- , SO_3^{2-}
b) HCN , CN^-
c) H_3PO_4 , H_2PO_4^-
d) O , OH^-
e) H_3O^+ , H_2O

Correct answers: 1C, 2C, 3D, 4B, 5B, 6C, 7A, 8B, 9E, 10D