

# Brainiacs Chemistry Olympiad Preliminary Round Sample Exam Paper 3

## Category I – grades 7 and 8

### Q1.

Which element is classified as a noble gas?

- A) Oxygen
- B) Argon**
- C) Nitrogen
- D) Hydrogen

### Q2.

Which of the following metals reacts with cold water to produce hydrogen gas?

- A) Copper
- B) Sodium**
- C) Aluminum
- D) Zinc

### Q3.

Which process involves the change of a solid directly to a gas?

- A) Evaporation
- B) Sublimation**
- C) Condensation
- D) Melting

### Q4.

The chemical formula for baking soda is:

- A) NaCl
- B) Na<sub>2</sub>CO<sub>3</sub>
- C) NaHCO<sub>3</sub>**
- D) CaCO<sub>3</sub>

### Q5.

What type of chemical reaction is represented by  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ ?

- A) Decomposition
- B) Synthesis**
- C) Combustion
- D) Single Displacement

**Q6.**

Which one of the following is not a greenhouse gas?

- A)  $\text{CO}_2$
- B)  $\text{CH}_4$
- C)  $\text{O}_2$**
- D)  $\text{N}_2\text{O}$

**Q7.**

Which of the following statements about allotropes of carbon is true?

- A) Graphite is harder than diamond
- B) Diamond conducts electricity
- C) Fullerenes are made of carbon atoms**
- D) Graphite has a tetrahedral structure

**Q8.**

What is the empirical formula of a compound containing 40% sulfur and 60% oxygen by mass?

- A)  $\text{SO}$
- B)  $\text{SO}_2$**
- C)  $\text{S}_2\text{O}_3$
- D)  $\text{SO}_3$

**Q9.**

How many grams are there in 2.5 moles of  $\text{NaOH}$ ?

- A) 100g**
- B) 200g
- C) 150g
- D) 250g

**Q10.**

In a special container two moles of  $\text{O}_2$  as is found at STP. How many liter volume does it occupies?

- A) 22,4L
- B) 44,8L**
- C) 33,6L
- D) 5,6L

**Q11.**

Which one of 16 grams of the following compounds has the largest volume at STP?

- A)  $O_2$
- B)  $SO_2$
- C)  $CO_2$
- D)  $CH_4$**

**Q12.**

At STP 5.6 L of  $XO_2$  gas has a mass of 11 g. Find the molar mass of X.

- A) 32g/mol
- B) 3g/mol
- C) 44g/mol**
- D) 64g/mol

**Q13.**

Which of the following is a non-renewable resource?

- A) Solar energy
- B) Wind energy
- C) Coal**
- D) Hydropower

**Q14.**

Which of the following statements best describes why ionic compounds conduct electricity when dissolved in water?

- A) They are non-polar
- B) They dissociate into ions**
- C) Water reduces their melting point
- D) They contain delocalized electrons

**Q15.**

What is the volume of  $1.204 \times 10^{22}$   $CO_2$  molecules, in mL at STP?

- A) 0.448mL
- B) 4.48mL
- C) 44.8mL
- D) 448 mL**

**Q16.**

What volume of carbon dioxide gas at STP will be released when 15 g of sodium carbonate containing 15% impurities is treated with an excess of hydrochloric acid?

A) 5,56L

B) 3,36L

C) 4,39L

**D) 2,69L**

**Q17.**

A chemical element consists of two isotopes. The nucleus of the first isotope contains 10 protons and 10 neutrons. The nucleus of the second isotope has 2 more neutrons than the first isotope. The ratio of lighter to heavier isotope atoms is 9:1. Calculate the average atomic mass of the element.

A) 32,3

B) 16,5

**C) 20,2**

D) 17,4

**Q18.**

When 10 g of a metal reacts with an acid solution, 4 liters of hydrogen gas at STP is released. Determine the metal.

A) Cd

B) Kr

**C) Fe**

D) Si

**Q19.**

When 4.5 grams of aluminum reacts with 33,6 liters of oxygen at STP to form aluminum oxide, what is the mass of aluminum oxide produced? (Al = 27, O = 16)

A) 8.5 g

**B) 17 g**

C) 22.5 g

D) 34 g

**Q20.**

Calculate the number of nitrogen atoms in 100 g of ammonium carbonate containing 10% non-nitrogen impurities.

A)  $1,13 \times 10^{24}$

B)  $3,01 \times 10^{23}$

C)  $6,02 \times 10^{24}$

D)  $2,24 \times 10^{23}$