1. Select **all** signs that suggest a chemical reaction.

   ☐ a precipitate forming

   ☐ a colour change

   ☐ a gas bubbling out

   Tick every correct option.

2. A spectator ion is one that...

   ☐ appears unchanged on both sides

   ☐ forms the precipitate

   ☐ is created in the reaction

3. Observing bubbles and a temperature rise is which level?

   ☐ particulate

   ☐ symbolic

   ☐ macroscopic

4. Burning wood into ash and smoke is a...

   ☐ chemical change

   ☐ physical change

   ☐ no change

5. In $2H_2 + O_2 \rightarrow 2H_2O$, how many moles of water form from 3 mol of O_2 (excess H_2)?

   _____ mol

6. 30 mL of acid is neutralized by 15 mL of 0.2 M base (1 to 1). The acid's molarity (in M)?

   _____ M

7. $A + B \rightarrow AB$ is which type of reaction?

   ☐ synthesis

   ☐ decomposition

   ☐ combustion

8. In the Bronsted-Lowry model, an acid is a substance that...

   ☐ donates an electron

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   ☐ accepts a proton

9. Oxidation and reduction always happen together in a redox reaction.

   ☐ True ☐ False

10. In a chemical reaction, the total mass of reactants equals the total mass of products.

    ☐ True ☐ False

1. **a precipitate forming; a colour change; a gas bubbling out**

   Colour change, gas, and a precipitate all hint at new substances.

2. **appears unchanged on both sides**

   Spectators do not change, so they cancel out.

3. **macroscopic**

   What you directly see and measure is the macroscopic level.

4. **chemical change**

   New substances (ash, gases) form, so it is chemical.

5. **6 mol**

   From the balanced equation, $\nu_{H_2O}/\nu_{O_2} = 2/1$. Thus $n_{H_2O} = n_{O_2}(2/1) = 3 \times 2 = 6$ mol, with excess hydrogen.

6. **0.1 M**

   For the stated 1:1 reaction, $M_a V_a = M_b V_b$. Rearrange: $M_a = M_b V_b / V_a = (0.2)(15)/30 = 0.10$ M. Both volumes use mL, so their units cancel.

7. **synthesis**

   Two things combining into one is a synthesis.

8. **donates a proton (H^+)**

   An acid is a proton donor; a base is a proton acceptor.

9. **True**

   Electrons lost by one species are gained by another.

10. **True**

    Atoms and total mass are conserved. A closed vessel retains all products; an open-vessel mass reading can change if gas enters or leaves. Constant mass alone does not prove a reaction occurred.

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