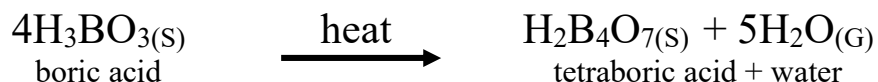


# Regents Exam Questions for Chemical Reactions

- Given the equation representing a reaction:  $3\text{Mg}_{(\text{s})} + \text{N}_{2(\text{g})} \rightarrow \text{Mg}_3\text{N}_{2(\text{s})}$   
What is the mass of  $\text{Mg}_3\text{N}_2$  that is produced when 14.58 grams of magnesium completely reacts with 5.60 grams of nitrogen? (from Aug 2023)  
(1) 8.98 g                      (2) 10.46 g                      (3) 20.18 g                      (4) 49.34 g
- Which solutions react to produce an insoluble compound?  
(1)  $\text{KCl}_{(\text{aq})} + \text{LiCl}_{(\text{aq})} \rightarrow$                       (2)  $\text{LiCl}_{(\text{aq})} + \text{NaNO}_{3(\text{aq})} \rightarrow$   
(3)  $\text{NaCl}_{(\text{aq})} + \text{AgClO}_{3(\text{aq})} \rightarrow$                       (4)  $\text{KNO}_{3(\text{aq})} + \text{AgClO}_{3(\text{aq})} \rightarrow$
- Given the equation representing a reaction:  $\text{F}_{2(\text{g})} + 2\text{KCl}_{(\text{aq})} \rightarrow 2\text{KF}_{(\text{aq})} + \text{Cl}_{2(\text{g})}$   
Which type of chemical reaction is represented by the equation? (from June 2023)  
(1) synthesis                      (2) decomposition                      (3) single replacement                      (4) double replacement
- Which statement describes what occurs when two iodine atoms react to produce an iodine molecule?  
(1) A bond forms and energy is absorbed.                      (2) A bond forms and energy is released.  
(3) A bond breaks and energy is absorbed.                      (4) A bond breaks and energy is released.
- Based on Table I, which equation represents conservation of mass and energy?  
(1)  $\text{CH}_{4(\text{g})} + \text{O}_{2(\text{g})} + \text{energy} \rightarrow \text{CO}_{2(\text{g})} + \text{H}_2\text{O}_{(\text{g})}$   
(2)  $\text{CH}_{4(\text{g})} + \text{O}_{2(\text{g})} \rightarrow \text{CO}_{2(\text{g})} + \text{H}_2\text{O}_{(\text{g})} + \text{energy}$   
(3)  $\text{CH}_{4(\text{g})} + 2\text{O}_{2(\text{g})} + \text{energy} \rightarrow \text{CO}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{g})}$   
(4)  $\text{CH}_{4(\text{g})} + 2\text{O}_{2(\text{g})} \rightarrow \text{CO}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{g})} + \text{energy}$
- Which formula represents chromium (III) oxide?  
(1)  $\text{CrO}_3$                       (2)  $\text{Cr}_3\text{O}$                       (3)  $\text{Cr}_2\text{O}_3$                       (4)  $\text{Cr}_3\text{O}_2$
- Which equation represents conservation of atoms?  
(1)  $\text{TiO}_2 + 2\text{Al} \rightarrow 2\text{Al}_2\text{O}_3 + \text{Ti}$                       (2)  $\text{TiO}_2 + 4\text{Al} \rightarrow 2\text{Al}_2\text{O}_3 + \text{Ti}$   
(3)  $3\text{TiO}_2 + 2\text{Al} \rightarrow 2\text{Al}_2\text{O}_3 + 3\text{Ti}$                       (4)  $3\text{TiO}_2 + 4\text{Al} \rightarrow 2\text{Al}_2\text{O}_3 + 3\text{Ti}$
- Given the balanced equation representing a reaction:  $2\text{KClO}_3 + \text{energy} \rightarrow 2\text{KCl} + 3\text{O}_2$   
What's the mass of  $\text{KCl}$  produced when 24.51 grams of  $\text{KClO}_3$  reacts to produce 9.60 grams of  $\text{O}_2$ ?  
(1) 5.31 g                      (2) 14.91 g                      (3) 34.11 g                      (4) 43.71 g
- Which type of reaction does this equation represent:  $2\text{NaCl} \rightarrow 2\text{Na} + \text{Cl}_2$   
(1) double replacement                      (2) decomposition                      (3) synthesis                      (4) single replacement
- Given the equation representing a reaction:  $2\text{H}_2(\text{g}) + 2\text{NO}_{(\text{g})} \rightarrow \text{N}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{g})}$   
What is the mass of  $\text{N}_{2(\text{g})}$  produced when 1.0 gram of  $\text{H}_{2(\text{g})}$  completely reacts with 15.0 grams of  $\text{NO}_{(\text{g})}$  to produce 9.0 grams of  $\text{H}_2\text{O}_{(\text{g})}$ ?  
(1) 7.0 g                      (2) 14.0 g                      (3) 25.0 g                      (4) 28.0 g

## PART 2 Problems – not multiple choice

Boric acid,  $\text{H}_3\text{BO}_3$ , is heated to produce tetraboric acid,  $\text{H}_2\text{B}_4\text{O}_7$ , and water.  
The equation below represents the reaction to form tetraboric acid.



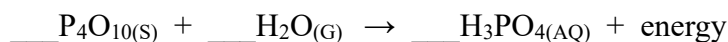
The tetraboric acid is then used to make borax, which is used as a cleaning agent. Borax,  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ , is a hydrate with a gram-formula mass of 381 grams per mole. A hydrate is a compound with water within its crystal structure. Borax has ten moles of water for every mole of  $\text{Na}_2\text{B}_4\text{O}_7$ .

11. Explain why the formula for tetraboric acid is an empirical formula.

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Phosphorus combines with oxygen to form an oxide that reacts with water to produce phosphoric acid, which is an important industrial compound used to produce fertilizers. An unbalanced equation for the production of phosphoric acid is shown here:  $\text{P}_4\text{O}_{10(\text{S})} + \text{H}_2\text{O}_{(\text{G})} \rightarrow \text{H}_3\text{PO}_{4(\text{AQ})} + \text{energy}$

12. Balance this equation using the smallest whole-number coefficients.



14. Write the empirical formula of the solid reactant in the equation.

15. Calculating the percent composition by mass of phosphorus in  $\text{P}_4\text{O}_{10}$  (gram-formula mass 284 u).

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Calcium oxide,  $\text{CaO}$ , also known as lime, is an important industrial chemical. Lime can be obtained by the heating of limestone, which is mainly calcium carbonate,  $\text{CaCO}_3$ . An equation representing the reaction for the production of lime is shown here.



16. State the solubility of limestone in water.

17. State evidence from the equation that the reaction to form lime is endothermic.