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VCE Chemistry ½
Stoichiometry [2.3]
Test Solutions

20 Marks. 1 Minute Reading. 16 Minutes Writing

Results:

Quiz Questions	_____ / 15
Extension Questions	_____ / 5

Section A: Quiz Questions (15 Marks)

Question 1 (3 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. When balancing a chemical equation our goal is to ensure that there are equal numbers of each atom on the left and right hand side of the equation.	✓	
b. The stoichiometric ratio can be identified by dividing the known by the unknown.		✓
c. Stoichiometry is used to identify how much of each reactant will be consumed in relation to one another in a given reaction.	✓	
d. The limiting reagent refers to the one that will be left over at the end of a chemical reaction.		✓
e. In the equation for the oxidation of silver, two moles of oxygen gas are consumed for every four moles of silver metal which is consumed.	✓	
f. An excess reagent refers to the reactant which must be more in order to allow the reaction to take place.		✓

Space for Personal Notes

Question 2 (8 marks)

Iron (II) hydroxide can be produced on the outside surface of pure exposed oxygen under ideal conditions. This reaction involves iron hydroxide coming in contact with water, in a typical metal-water reaction.

a. Provide the balanced equation for the formation of iron hydroxide. (1 mark)

$$Fe(s) + 2H_2O(l) \rightarrow Fe(OH)_2(aq) + H_2(g)$$

b. Harry reacts 48.0 grams of iron with water and wishes to convert all of the iron to iron oxide. How much water would be necessary to achieve this? (3 marks)

$n(Fe) = \frac{48}{55.8} = 0.8602$ mol

$n(H_2O) = 2 \times n(Fe)$
$= 1.720$

$m(H_2O) = n \times M$
$= 1.720 \times 18$
$= 30.97$ g mol

c. Given that Harry's reaction produced three moles of hydrogen gas, what would be the moles of OH^- ions produced from this same reaction? (2 marks)

$n(Fe(OH)_2) = n(H_2)$
$= 3$ mol

$n(OH^-) = 2 \times n(Fe(OH)_2)$
$= 2 \times 3 = 6$ mol

d. If Harry mixed 12.0 grams of iron with 25.0 grams of water, which one would be the excess reagent? (2 marks)

$n(Fe) = \frac{12}{55.8} = 0.2151$ mol $\quad n(H_2O) = \frac{25}{18} = 1.389$ mol

$\frac{0.2151}{1} = 0.2151$ mol $\quad \frac{1.389}{2} = 0.6945$ mol

∴ Iron is limiting & H_2O is excess.

Space for Personal Notes

Question 3 (4 marks)

When a mixture of xenon and fluorine is mixed in one to six ratios at temperatures above 400℃ xenon hexafluorine is able to form.

a. Provide the balanced equation for the formation of fluorine hexafluoride. (1 mark)

$Xe + 3F_2 \rightarrow XeF_6$

b. Explain why fluorine hexafluoride is unlikely to form at SLC. (1 mark)

Xenon is an example of a noble gas, and as a result it has a full outer shell and is inert.

c. If a reaction were to occur in a chamber with 2.00 g of xenon exactly, what mass of fluorine would need to be added? (2 marks)

$n(Xe) = 0.0152$
$n(F_2) = 0.045699$
$m(F_2) = 1.73656\ g$

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Section B: Extension Questions (5 Marks)

Question 4 (5 marks)

Octane is a fuel that is widely available at petrol stations and used as the main reactant in internal combustion engines for modern vehicles.

a. Balance the equation for the combustion of octane. (1 mark)

$$C_8H_{18}\,(l) + O_2\,(g) \rightarrow H_2O\,(l) + CO_2\,(g)$$

$$C_8H_{18}\,(l) + \frac{25}{2}O_2\,(g) \rightarrow 9H_2O\,(l) + 8CO_2\,(g)$$

b. Sia wants to know how much oxygen her car will need in order to combust the octane she just put into the tank. Given that octane has a density of 0.79 kg/L and she just filled up with 45 litres, how many grams of oxygen would she need? (3 marks)

$m(C_8H_{18}) = 45 \times 0.79$
$= 35.55kg$
$= 3.555 \times 10^4 g$
$n(C_8H_{18}) = \frac{3.555 \times 10^4}{8(12.01) + 18(1.01)} = 311.8mol$

$n(O_2) = \frac{25}{2} \times n(C_8H_{18}) = 3.898 \times 10^3\ mol$
$m(O_2) = 3.898 \times 10^3 \times 32$

$= 1.2 \times 10^5 g\ (2\ s.f.)$

c. Given that this much oxygen was consumed, how many moles of carbon dioxide would be produced? (1 mark)

$n(CO_2) = \frac{16}{25} \times n(O_2)$
$= \frac{16}{25} \times 3.898 \times 10^3$

$= 2.5 \times 10^3\ mol\ (2\ s.f.)$

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