Name:
Score: 0 / 20 points (0%)

Chapter 16 Review Quiz

Multiple Choice
Identify the choice that best completes the statement or answers the question.

___ 1. Chemical synthesis refers to:
a. chemistry being used to produce a reaction.
b. chemistry being used to break a substance down.
c. chemistry being applied to produce a new product.
d. new branches of chemistry being discovered.

ANSWER: C
Chemical synthesis involves the use of chemical reactions to produce a specific product.
POINTS: 0 / 1
FEEDBACK:
REF: 488

___ 2. What factor would *not* be considered important when designing a chemical synthesis reaction?
a. availability of the reactants
b. cost
c. amount of wastage
d. name of the product

ANSWER: D
The name of the product is not relevant to the synthesis reaction.
POINTS: 0 / 1
FEEDBACK:
REF: 488

___ 3. The name given to the process where the products are considered and then chemists work backwards to determine the reactants is:
a. retrosynthetic analysis.
b. backwards analysis.
c. retrospective analysis.
d. reverse analysis.

ANSWER: A
A common method of designing synthesis reactions is retrosynthetic analysis in which chemists start with the products and work backwards to determine the reactants.
POINTS: 0 / 1
FEEDBACK:
REF: 490

___ 4. In the following reaction:
$NO^2 + NO_2 \rightarrow NO + NO_3$
$NO_3 + CO \rightarrow NO_2 + CO_2$

the NO_3 would be considered:
a. a reactant.
b. an intermediate.

c. a product.
d. a waste.

ANSWER: B
NO_3 is a product in the first step then a reactant in the second so it is an intermediate produced then used in the process.
POINTS: 0 / 1
FEEDBACK:
REF: 491

___ 5. The contact process is used to produce:
a. ammonia.
b. sulfur dioxide.
c. sodium hydroxide.
d. sulfuric acid.

ANSWER: D
The contact process is a multistep process in which sulfuric acid is the desired final product.
POINTS: 0 / 1
FEEDBACK:
REF: 491

___ 6. What is the reaction below an example of?

$NO + NO \rightarrow N_2O_2$

$N_2O_2 + H_2 \rightarrow N_2O + H_2O$

$N_2O + H_2 \rightarrow N_2 + H_2O$

a. linear pathway
b. divergent pathway
c. convergent pathway
d. parabolic pathway

ANSWER: A
A linear pathway has one reaction following another with the products of one reaction becoming the reactants of the next.
POINTS: 0 / 1
FEEDBACK:
REF: 491

___ 7. The intermediate(s) of the reaction below is/are:

$NO + NO \rightarrow N_2O_2$

$N_2O_2 + H_2 \rightarrow N_2O + H_2O$

$N_2O + H_2 \rightarrow N_2 + H_2O$

a. N_2O_2 only.
b. N_2O_2 and N_2O.
c. H_2 and N_2O.
d. N_2O_2, H_2 and H_2O.

ANSWER: B
Intermediates are produced in one reaction then used in another. Intermediates are not present at the beginning or end of the process.
POINTS: 0 / 1
FEEDBACK:
REF: 490

___ 8. Which of the following processes is a convergent sequence?
a. contact process
b. oxidation of a primary alcohol forming a carboxylic acid
c. esterification
d. hydrogenation of ethene

ANSWER: C
Esterification requires the production of an alcohol and the production of a carboxylic acid which are then reacted together to produce the ester.
POINTS: 0 / 1
FEEDBACK:
REF: 491

___ 9. Which of the following would not affect the yield of a reaction?
a. the temperature of the reaction mixture
b. the pressure of a gaseous system
c. removing the products from the reaction mixture
d. the addition of a catalyst

ANSWER: D
A catalyst increases the rate of the reaction but does not affect the total amount of product formed.
POINTS: 0 / 1
FEEDBACK:
REF: 492

___ 10. Consider the following reaction in the direct synthesis of hydrogen chloride.

$$Cl_2(g) + H_2(g) \rightleftharpoons 2\,HCl(g) + 185\ kJ$$

Which of the following would increase the yield of hydrogen chloride?
a. Increasing the volume of the reaction vessel
b. Decreasing the temperature of the reaction mixture
c. Limiting the amount of chlorine gas available
d. Adding neon gas to the reaction mixture

ANSWER: B
Decreasing the temperature would drive the reaction in the exothermic (forward) direction, thus increasing the amount product.
POINTS: 0 / 1
FEEDBACK:
REF: 492

___ 11. The second step of the contact process is shown below.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

In this reaction, a high pressure would:
a. increase the reaction rate.
b. increase the yield of sulfur trioxide.
c. increase both the rate and the yield.
d. increase neither the rate nor the yield.

ANSWER: C
A high pressure would increase the number of collisions between reactants, thus increasing the rate of reaction. A high pressure would also drive the reaction in the forward direction where there are less gas molecules.
POINTS: 0 / 1
FEEDBACK:
REF: 494

12. The Haber process is used to produce:
    a. nitrogen gas.
    b. hydrogen gas.
    c. ammonia gas.
    d. ammonium ions.

ANSWER: C
The Haber process is used to produce ammonia, which is a feedstock for the production of nitrogen-based fertilisers.
POINTS: 0 / 1
FEEDBACK:
REF: 495

13. Which condition is chosen as a compromise between the rate and yield in the Haber process?
    a. concentration of nitrogen gas
    b. pressure of the system
    c. presence of an iron/iron oxide catalyst
    d. temperature

ANSWER: D
Increasing the temperature will increase the rate while decreasing the temperature will increase the yield so a compromise temperature is used to ensure the production of enough ammonia (yield) in an adequate time (rate).
POINTS: 0 / 1
FEEDBACK:
REF: 495

14. Aspirin ($C_9H_8O_4$) can be produced from the reaction between acetic anhydride ($C_4H_6O_3$) with salicylic acid ($C_7H_6O_3$).

$$C_4H_6O_3 + C_7H_6O_3 \rightarrow C_9H_8O_4 + C_2H_4O_2$$

What is the limiting reactant when 21 g of acetic anhydride reacts with 25 g of salicylic acid?
    a. Acetic anhydride
    b. Salicylic acid
    c. Neither, because they are in the correct stoichiometric ratio.
    d. Neither, because the reaction will not occur.

ANSWER: B
There is 0.206 mol acetic anhydride and 0.181 mol salicylic acid. The reaction ratio is 1:1 so salicylic acid is the limiting reagent.
POINTS: 0 / 1
FEEDBACK:
REF: 496

15. Aspirin ($C_9H_8O_4$) can be produced from the reaction between acetic anhydride ($C_4H_6O_3$) with salicylic acid ($C_7H_6O_3$).

$$C_4H_6O_3 + C_7H_6O_3 \rightarrow C_9H_8O_4 + C_2H_4O_2$$

What mass of aspirin is produced when 21 g of acetic anhydride reacts with 25 g of salicylic acid?
    a. 4.5 g
    b. 32.6 g
    c. 37.1 g
    d. 69.7 g

ANSWER: B
0.181 mol salicylic acid. The reaction ratio is 1:1, salicylic acid is the limiting reagent. Moles aspirin = 0.181 mol. Mass aspirin = $0.181 \times 180 = 32.6$ g.

POINTS: 0 / 1
FEEDBACK:
REF: 498

___ 16. What information is not required to calculate the percentage yield of a reaction?
a. moles of the reactants used
b. mass of the desired product produced
c. the use of the product
d. a balanced chemical equation

ANSWER: C
The use of the product is irrelevant to the calculation of percentage yield.
POINTS: 0 / 1
FEEDBACK:
REF: 498

___ 17. It was calculated that 10.0 g of carbon dioxide could be produced from the reaction between hydrochloric acid and calcium carbonate. When the reaction occurred only 8.80 g was produced. What is the percentage yield for the reaction?
a. 100 %
b. 88.0 %
c. 10.0 %
d. 8.80 %

ANSWER: B
Percentage yield = (actual mass/theoretical mass) $\times$100 %
POINTS: 0 / 1
FEEDBACK:
REF: 498

___ 18. Ethanoic acid is produced by the oxidation of ethanol according to the reaction:

$3CH_3CH_2OH(aq) + 2Cr_2O_7^{2-}(aq) + 16H^+(aq) \rightarrow 3CH_3COOH(aq) + 4Cr^{3+}(aq) + 11H_2O(l)$

If 1.5 g of ethanoic acid is synthesised from 1.5 g of ethanol, what is the percentage yield?
a. 23%
b. 30%
c. 77%
d. 100%

ANSWER: C
Theoretical yield = (1.5/46) $\times$ 60 = 1.96 g; % yield = (1.5/1.96) $\times$100% = 77%
POINTS: 0 / 1
FEEDBACK:
REF: 498

___ 19. Which of the following techniques would be an effective way of checking the purity of a sample?
a. IR spectroscopy
b. Gravimetric analysis
c. Volumetric analysis
d. All of the above

ANSWER: D
All the methods listed could be used to check the purity of a sample.
POINTS: 0 / 1
FEEDBACK:

REF: 501

___ 20. The purity of a sample of glacial acetic acid (CH_3COOH) was being checked by the quality control manager before being distributed.
A 10 mL sample of glacial acetic acid was diluted to 100 mL. 10 ml of the diluted sample was analysed by titration and required 50 mL of 0.3 mol L^{-1} NaOH to reach end point. If pure glacial acetic acid has a molarity of 17.4 mol L^{-1} what is the purity of sample being analysed?
a. 8.6 %
b. 43 %
c. 86 %
d. 100 %

ANSWER: C
Concentration of titrated sample is 1.5 mol L^{-1},
so undiluted sample is 15 mol L^{-1}. % purity = (15/17.4) $\times$100 = 86 %
POINTS: 0 / 1
FEEDBACK:
REF: 501

Retake