


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:
- chemistry being used to produce a reaction.
 - chemistry being used to break a substance down.
 - chemistry being applied to produce a new product.
 - 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?
- availability of the reactants
 - cost
 - amount of wastage
 - 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:
- retrosynthetic analysis.
 - backwards analysis.
 - retrospective analysis.
 - 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:
- $$\text{NO}^2 + \text{NO}_2 \rightarrow \text{NO} + \text{NO}_3$$
- $$\text{NO}_3 + \text{CO} \rightarrow \text{NO}_2 + \text{CO}_2$$

the NO_3 would be considered:

- a reactant.
- 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.

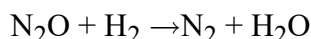
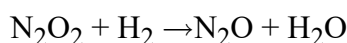
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6. What is the reaction below an example of?



- 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.

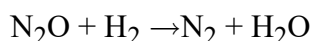
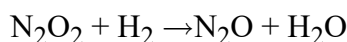
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7. The intermediate(s) of the reaction below is/are:



- 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?
- contact process
 - oxidation of a primary alcohol forming a carboxylic acid
 - esterification
 - 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?
- the temperature of the reaction mixture
 - the pressure of a gaseous system
 - removing the products from the reaction mixture
 - 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.
- $$\text{Cl}_2(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons 2 \text{HCl}(\text{g}) + 185 \text{ kJ}$$

Which of the following would increase the yield of hydrogen chloride?

- Increasing the volume of the reaction vessel
- Decreasing the temperature of the reaction mixture
- Limiting the amount of chlorine gas available
- Adding neon gas to the reaction mixture


ANSWER: B

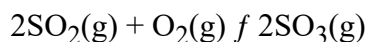
Decreasing the temperature would drive the reaction in the exothermic (forward) direction, thus increasing the amount product.

POINTS: 0 / 1

FEEDBACK:

REF: 492

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



In this reaction, a high pressure would:

- increase the reaction rate.
- increase the yield of sulfur trioxide.
- increase both the rate and the yield.
- 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).

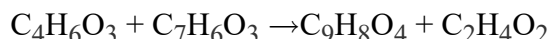
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14. Aspirin ($C_9H_8O_4$) can be produced from the reaction between acetic anhydride ($C_4H_6O_3$) with salicylic acid ($C_7H_6O_3$).



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.

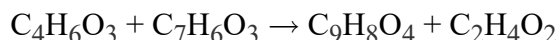
POINTS: 0 / 1

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REF: 496



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




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

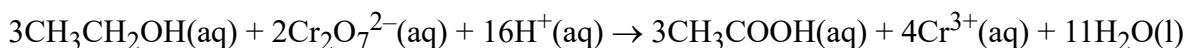
The use of the product is irrelevant to the calculation of percentage yield.

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: BPercentage 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:



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: CTheoretical 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