

Name:

Score: 0 / 20 points (0%)

## Chapter 13 Review Quiz

## Multiple Choice

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



1. Which of the following is an example of a thermosetting polymer?

- a. polyethylene
- b. polyvinyl chloride
- c. polyethylene terephthalate
- d. polyurethane

ANSWER: D

Thermosetting plastics are stronger, more chemically resistant and durable than thermoplastic polymers. Polyurethane is a thermosetting polymer used in insulating foams.

POINTS: 0 / 1

FEEDBACK:

REF: 369



2. Compare the conditions for the different types of cracking. Which line of the table below correctly shows the most likely values of temperature and pressure for thermal and catalytic cracking?

	Thermal cracking		Catalytic cracking	
	Temperature (°C)	Pressure (atm)	Temperature (°C)	Pressure (atm)
i	500	15	700	70
ii	500	70	700	15
iii	700	15	500	70
iv	700	70	500	15

- a. i
- b. ii
- c. iii
- d. iv

ANSWER: D

Catalytic cracking uses a zeolite catalyst, so it requires a lower temperature and pressure than thermal cracking.

POINTS: 0 / 1

FEEDBACK:

REF: 369



3. Which equation represents a cracking reaction?

- a.  $2\text{C}_3\text{H}_6(\text{g}) + \text{C}_2\text{H}_4(\text{g}) + \text{C}_4\text{H}_{14}(\text{l}) \xrightarrow{\text{catalyst}} \text{C}_{14}\text{H}_{30}(\text{l})$
- b.  $\text{C}_{14}\text{H}_{30}(\text{l}) \xrightarrow{\text{catalyst}} 2\text{C}_2\text{H}_4(\text{g}) + \text{C}_3\text{H}_6(\text{g}) + \text{C}_7\text{H}_{16}(\text{l})$
- c.  $2\text{C}_{14}\text{H}_{30}(\text{l}) + 43\text{O}_2(\text{g}) \rightarrow 14\text{CO}_2(\text{g}) + 15\text{H}_2\text{O}(\text{l})$
- d.  $\text{C}_{14}\text{H}_{30}(\text{l}) \xrightarrow{\text{catalyst}} [\text{CH}_2 - \text{CH}_2] \quad (\text{s})$

ANSWER: B

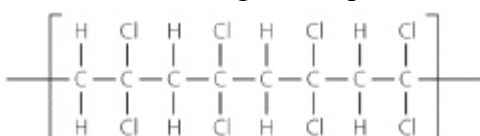
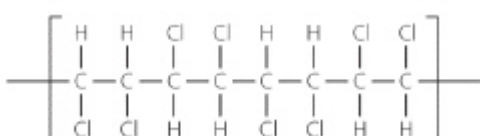
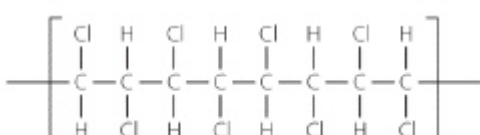
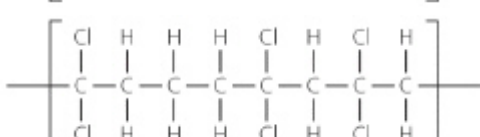
Cracking is a reaction that breaks the bonds in a longer chain hydrocarbon to form shorter chain hydrocarbons, including alkanes and alkenes.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 370

 4. Which of the following shows part of the polymer produced from  $\text{Cl}_2\text{C} = \text{CH}_2$ ?

- a. 
- b. 
- c. 
- d. 


**ANSWER:** A

This is an example of addition polymerisation. The monomer has 2 chlorines on one carbon and 2 hydrogens on the other carbon. Therefore, the polymer should show this same pattern of 2 chlorines on one carbon and 2 hydrogens on the adjacent carbon.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 371

 5. Select the correct comparison of structure and melting point of HDPE with those for LDPE.

	HDPE		LDPE	
	Structure	Property	Structure	Property
i	branched	higher boiling point	unbranched	higher boiling point
ii	branched	lower boiling point	unbranched	lower boiling point
iii	unbranched	higher boiling point	branched	lower boiling point
iv	unbranched	lower boiling point	branched	higher boiling point

- a. i  
b. ii  
c. iii  
d. iv


**ANSWER:** C

HDPE is unbranched, so chains of the polymer can pack more tightly together. Therefore, it requires more energy to separate them and has a higher boiling point.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 372

 6. Select the correct comparison of structure and use of LDPE to HDPE.

	LDPE		HDPE	
	Structure	Use	Structure	Use
i	amorphous	lamination film for cardboard used in milk cartons	crystalline	caps for drink bottles
ii	amorphous	caps for drink bottles	crystalline	lamination film for cardboard used in milk cartons
iii	crystalline	lamination film for cardboard used in milk cartons	amorphous	caps for drink bottles
iv	crystalline	caps for drink bottles	amorphous	lamination film for cardboard used in milk cartons

- a. i  
b. ii  
c. iii  
d. iv

**ANSWER:** A

LDPE is amorphous, which means disordered, i.e. branched. Hence, plastic is flexible and is used for lamination film for cardboard used in milk cartons.  
HDPE is crystalline, which means ordered, i.e. unbranched, linear chains. Hence, it is more rigid and is used for caps for drink bottles.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 372



7. Which of the structures is the monomer for Teflon™?

- a.  $\text{CH}_2 = \text{CH}_2$   
b.  $\text{C}_6\text{H}_5 - \text{CH} = \text{CH}_2$   
c.  $\text{CH}_2 = \text{CH} - \text{Cl}$   
d.  $\text{CF}_2 = \text{CF}_2$

**ANSWER:** D

Teflon™ is poly(tetrafluoroethylene), so the monomer is tetrafluoroethylene,  $\text{CF}_2 = \text{CF}_2$ .

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 376



8. Select the correct comparison of forces between the polymer chains of PVC with polyethylene.

	PVC	polyethylene
i	dispersion	dispersion
ii	dipole–dipole	dispersion
iii	dispersion	dipole–dipole
iv	dipole–dipole	dipole–dipole

- a. i  
b. ii  
c. iii  
d. iv


**ANSWER:** B

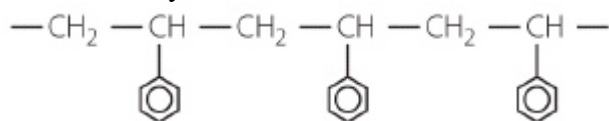
PVC has dipole–dipole interactions between polymer chains while polyethylene has dispersion forces between polymer chains.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 377

 9. What is the systematic name for the monomer that makes this polymer?



- Phenylbenzene
- Chloroethene
- Ethenylbenzene
- Styrene

**ANSWER:** C

The polymer is polystyrene. Hence, the monomer is styrene. The systematic name for styrene is ethenylbenzene.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 378

 10. Which of the following polymers is an adhesive?

- Poly(vinyl chloride)
- Polytetrafluoroethylene
- Polyacrylonitrile
- Poly(vinyl acetate)


**ANSWER:** D

Poly(vinyl acetate), also known as PVA.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 379

 11. Which of the following is a copolymer?

- polyethylene
- polystyrene
- polyethylene terephthalate
- cellulose


**ANSWER:** C

A copolymer is a polymer made from two different polymers. PET, polyethylene terephthalate, is an example of this. It is composed of ethylene glycol and terephthalic acid.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 380

 12. The densities ( $\text{g cm}^{-3}$ ) of common plastics are:

- HDPE 0.95–0.97
- LDPE 0.917–0.940
- PP 0.90–0.91
- PS (in solid form) 1.04–1.05

A 50 g sample of a polymer occupied a volume of  $53.8 \text{ cm}^3$ . What is the name of the polymer?

- HDPE
- LDPE
- PP


d. PS

**ANSWER:** B

$$\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{50}{53.8} = 0.929 \text{ gcm}^{-3}$$

This is within the range for LDPE.

**POINTS:** 0 / 1**FEEDBACK:****REF:** 385


 13. Which of the following only contains examples of synthetic condensation polymers?

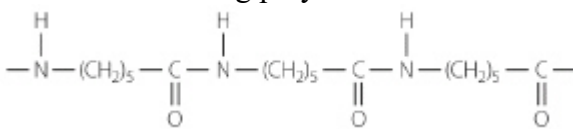
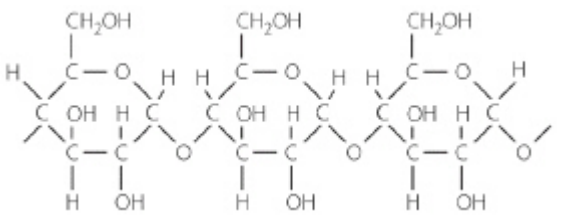
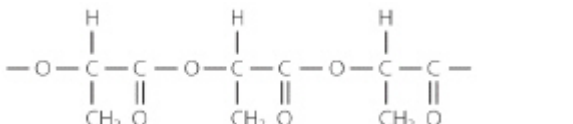
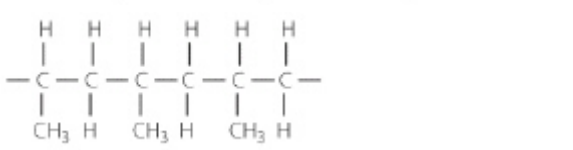
- a. Polyesters and polyamides
- b. Polyesters and polyethylene
- c. Polysaccharides and proteins
- d. Polysaccharides and polyamides

**ANSWER:** A

Polyesters and polyamides are synthetic condensation polymers, while polysaccharides and proteins are natural condensation polymers. Polyethylene is an addition polymer.

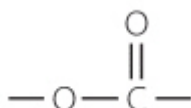
**POINTS:** 0 / 1**FEEDBACK:****REF:** 387


 14. Which of the following polymers contains an ester linkage?

- a. 
- b. 
- c. 
- d. 

**ANSWER:** C

An ester linkage contains the following functional group

**POINTS:** 0 / 1**FEEDBACK:****REF:** 389

 15. Which of the following is not classified as an amino acid?

a.

- $$\begin{array}{c} \text{NH}_2 \quad \text{CH}_3 \\ | \quad | \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{CH}_3 \\ || \quad | \quad | \\ \text{O} \quad \text{H} \quad \text{H} \end{array}$$
- b. 
$$\begin{array}{c} \text{H} \quad \text{H} \quad \text{CH}_3 \quad \text{O} \\ | \quad | \quad | \quad || \\ \text{H}-\text{N}-\text{C}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \quad | \\ \text{H} \quad \text{CH}_3 \quad \text{H} \end{array}$$
- c. 
$$\begin{array}{c} \text{H} \quad \text{H} \quad \text{O} \\ | \quad | \quad || \\ \text{H}-\text{N}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \quad | \\ \text{H} \quad \text{CH}_2\text{OH} \quad \text{OH} \end{array}$$
- d. 
$$\begin{array}{c} \text{NH}_2 \\ | \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{H} \\ || \quad | \quad | \\ \text{O} \quad \text{H} \quad \text{H} \end{array}$$


**ANSWER:** B

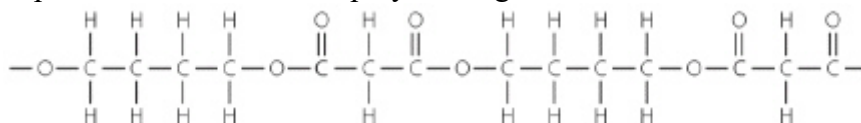
Amino acids have a specific structure where the —H, —COOH and —NH<sub>2</sub> are all attached to the same carbon atom. In B, the —NH<sub>2</sub> and —COOH are attached to different carbon atoms.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:**

 16. A part of the structure of a polymer is given below.



Which of the following shows the structures of the monomers used to produce this polymer?

- a. 
$$\begin{array}{c} \text{O} \quad \text{H} \quad \text{O} \\ || \quad | \quad || \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \\ \text{H} \end{array} \quad \text{and} \quad \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ | \quad | \quad | \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$$
- b. 
$$\begin{array}{c} \text{O} \quad \text{H} \quad \text{H} \quad \text{O} \\ || \quad | \quad | \quad || \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \\ \text{H} \quad \text{H} \end{array} \quad \text{and} \quad \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ | \quad | \quad | \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$$
- c. 
$$\begin{array}{c} \text{O} \quad \text{H} \quad \text{O} \\ || \quad | \quad || \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \\ \text{H} \end{array} \quad \text{and} \quad \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ | \quad | \quad | \quad | \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$$
- d. 
$$\begin{array}{c} \text{O} \quad \text{H} \quad \text{H} \quad \text{O} \\ || \quad | \quad | \quad || \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \\ \text{H} \quad \text{H} \end{array} \quad \text{and} \quad \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ | \quad | \quad | \quad | \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$$

**ANSWER:** C

The —O— links the diol to the dicarboxylic acid. There are 4 carbons in the diol and 3 carbons in the dicarboxylic acid.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 389

 17. Which of the following describes the PET polymer?

- a. Condensation polymer, thermoplastic

- b. Addition polymer, thermoplastic
- c. Condensation polymer, thermosetting
- d. Addition polymer, thermosetting

**ANSWER:** A

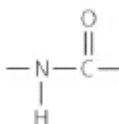
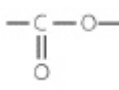
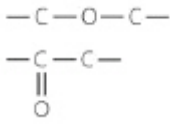
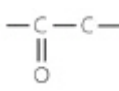
PET is composed of ethylene glycol and terephthalic acid joining together and releasing water molecule as each monomer is added; hence, it is a condensation polymer. It can be repeatedly melted and reshaped. Therefore, it is a thermoplastic polymer.

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 388

 18. Which of the following is a glycosidic link?

- a. 
- b. 
- c. 
- d. 


**ANSWER:** C

A glycosidic link is  $\text{—C—O—C—}$ .

**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 396

 19. Which of the following links the polymer to its monomer?

- glycogen    cellulose    starch
- a.  $\alpha$ -glucose     $\beta$ -glucose     $\alpha$ -glucose
  - b.  $\alpha$ -glucose     $\alpha$ -glucose     $\beta$ -glucose
  - c.  $\alpha$ -glucose     $\beta$ -glucose     $\beta$ -glucose
  - d.  $\beta$ -glucose     $\beta$ -glucose     $\alpha$ -glucose

**ANSWER:** A

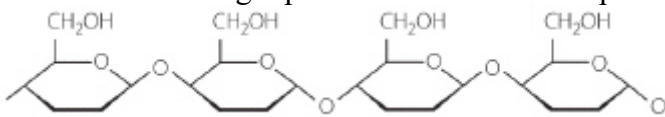
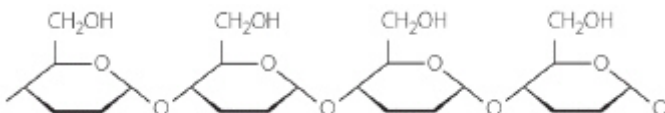

Both glycogen and starch are polymers composed of  $\alpha$ -glucose monomers while cellulose is composed of  $\beta$ -glucose monomers.

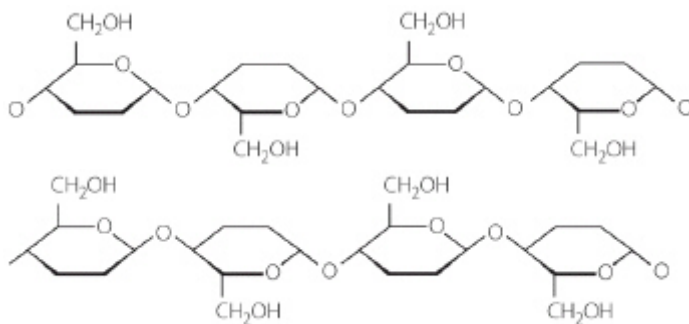
**POINTS:** 0 / 1

**FEEDBACK:**

**REF:** 396

 20. Which of the following represents the structure of part of the cellulose polymer?

- a. 
- b. 
- c. 



d.

**ANSWER:** D

Cellulose is formed when many  $\beta$ -glucose monomers join together forming 1,4 – glycosidic linkages.

**POINTS:** 0 / 1**FEEDBACK:****REF:** 397