شرح وتلخيص التفاعلات الكيميائية – الدرس الثاني من الوحدة السادسة



تم تحميل هذا الملف من موقع المناهج الإماراتية	
موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف التاسع المتقدم ⇦ أحياء ⇦ الفصل الأول ⇦ ملفات متنوعة ⇦ الملف	
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التواصل الاجتماعي بحسب الصف التاسع المتقدم					
صفحة المناهج الإماراتية على فيسبوك					
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المزيد من الملفات بحسب الصف التاسع المتقدم والمادة أحياء في الفصل الأول	
شرح وتلخيص التفاعلات الكيميائية – الدرس الثاني من الوحدة السادسة	1
أسئلة على درس الذرات والعناصر والمركبات _ بريدج	2

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Chemical Reactions

my handwritten summary * figures * tables * quizzes

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Rust = chemical change!

Key questions

1. How are reactants changed into products?
2. Why must equations balance?
3. How do enzymes facilitate life?

Inside this notebook

- ✓ Step-by-step lesson notes
- ✓ Energy diagrams and examples
- ✓ Clear comparisons & tables
- ✓ Section & unit MCQ practice
- ✓ Full explained answer key

Words to master

chemical reaction | reactants | products | coefficient | activation energy | exothermic | endothermic | catalyst | enzyme | substrate | active site

The big idea

Enzymes are biological catalysts: they speed up essential chemical reactions by lowering activation energy.

From rusting iron to reactions inside every cell!

1. What is a chemical reaction?

Main idea

Chemical reaction

Atoms or groups of atoms are reorganized into different substances. Chemical bonds break and new bonds form.

Two changes – do not mix them up!



CHEMICAL: rusting iron

Change Compositions



PHYSICAL: boiling water

Change States and Characteristics

Compare	Chemical change	Physical change
What changes?	Composition changes; a new substance forms.	Only appearance or state changes.
Example	Iron reacts with oxygen to form rust (iron oxide).	Water boils; its chemical makeup stays the same.
Clues	Heat or light may be produced; a new solid, liquid, or gas may appear.	The substance is still the same material.

Remember

Chemical change = new substances. Physical change = no change in composition.

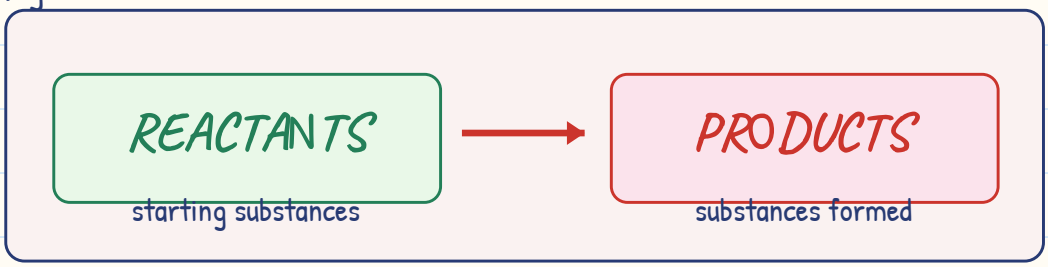
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2. Reactants & products

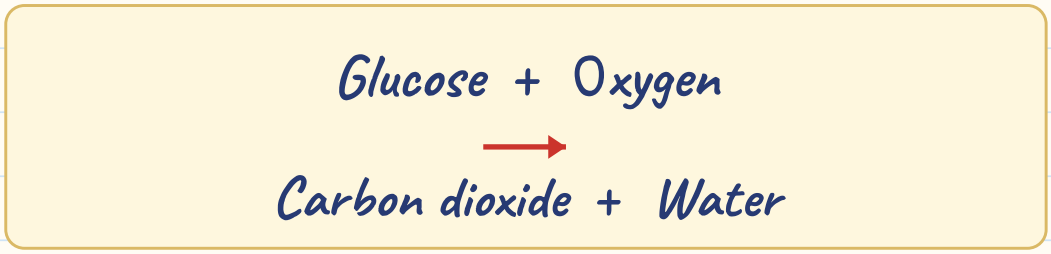
How to read a chemical equation

Scientists write a reaction using chemical formulas and an arrow showing the direction of change.



Example: a reaction in your cells

Glucose reacts with oxygen to produce carbon dioxide and water. This reaction provides the body with energy.



In formulas (not yet balanced): $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$

Parts of an equation

Term	What it means
Reactants	Chemicals on the left side of the arrow.
Products	Chemicals on the right side of the arrow.
Arrow	Read it as yields or reacts to form.

Check yourself

In A + B → AB, which substances are reactants? Which is the product?

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3. Keeping equations balanced

The law of conservation of mass

Matter is conserved

During a chemical reaction, matter cannot be created or destroyed. So each element must have the same number of atoms on both sides.

How scientists balance equations

Change the large numbers in front of formulas (coefficients), not the small numbers inside formulas (subscripts).

Balanced cellular respiration:

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

same atoms on both sides

Count the atoms

Element	Reactant side	Product side
Carbon (C)	6	6
Hydrogen (H)	12	12
Oxygen (O)	18	18

Four simple steps

1. Write the correct chemical formulas.
2. Count atoms of each element on both sides.
3. Add coefficients until the counts match.
4. Recount to check the equation.

Try it: $2H_2O_2 \rightarrow 2H_2O + O_2$ is balanced. Can you count the oxygen atoms?

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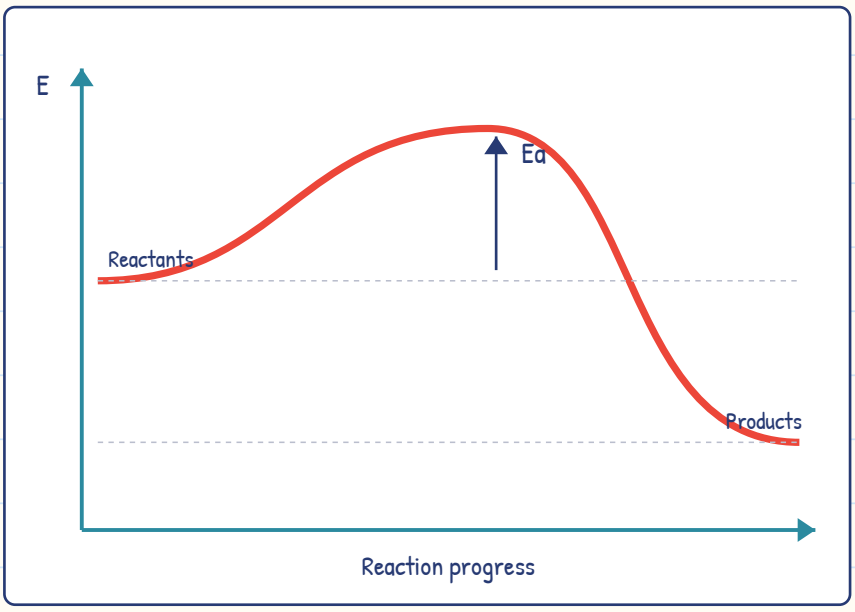
4. Activation energy

Every reaction needs a starting push

Most chemical reactions require an input of energy before they can begin. The minimum energy required to start a reaction is called activation energy.

Think of a candle

A candle wick does not burn until it is lit. The match flame supplies the energy needed to start the reaction.





Energy diagram: the hill is the energy barrier.

Reading the graph

- Y-axis = energy; X-axis = reaction progress.
- The peak marks the highest-energy point.
- The rise to the peak is the activation energy.
- In this diagram, lower-energy products mean energy is released.

Another example

Cookie dough needs heat in the oven before its ingredients can react and become a cookie.

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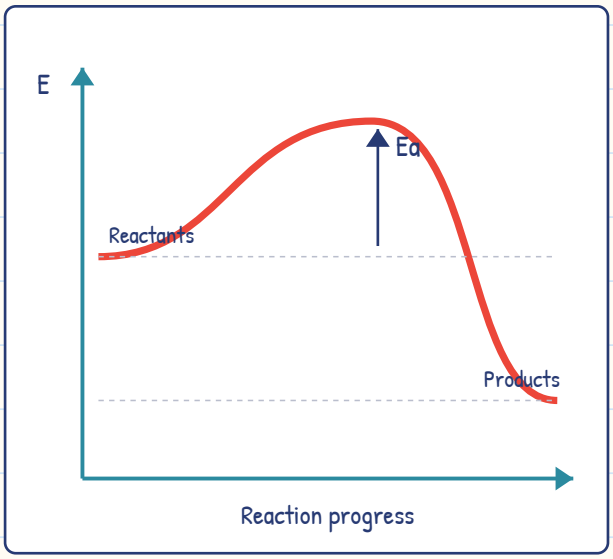
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5. Exothermic or endothermic?

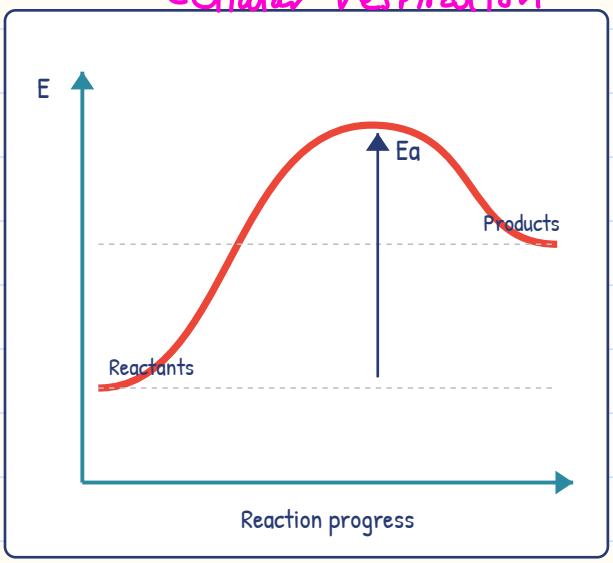
Both require activation energy

Reactions can release energy or absorb energy. Compare the relative energy of reactants and products.

EXOTHERMIC photosynthesis



ENDOTHERMIC cellular respiration



Compare	Exothermic	Endothermic
Energy	Energy is released.	Energy is absorbed.
Products	Have less energy than reactants.	Have more energy than reactants.
Examples	Cellular respiration.	Photosynthesis; instant cold pack.



A cool example

An instant cold pack absorbs heat energy during an endothermic reaction. That is why it feels cold.

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6. Catalysts & enzymes

Why catalysts matter

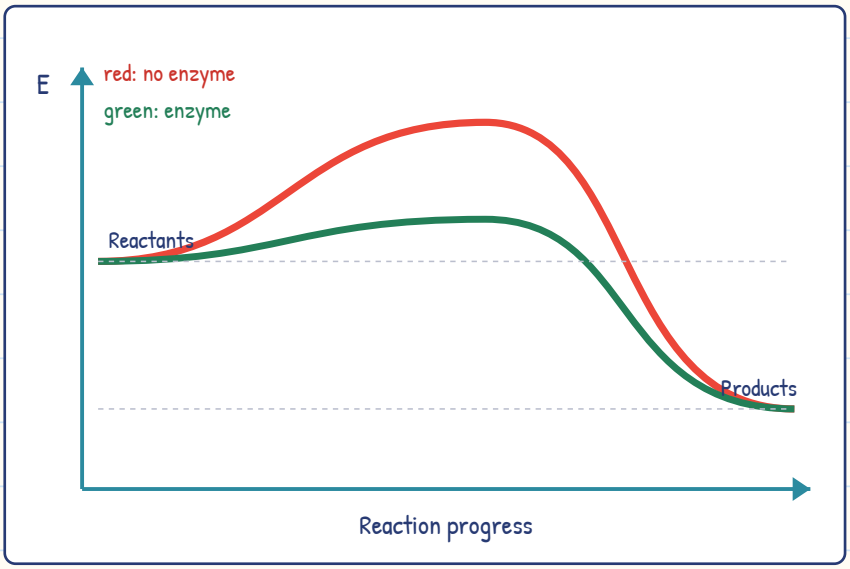
Some reactions would be far too slow for life. A catalyst reduces the activation energy and speeds up a chemical reaction.

The catalyst rule

A catalyst is not used up and can be used again. It does not increase the amount of product formed.

Enzymes are biological catalysts

Enzymes are special proteins that lower the activation energy of biochemical reactions.



Notice!

The green curve has a lower peak.

The enzyme helps the reaction happen faster.

Meet three digestive enzymes

Enzyme	Action
Amylase	Breaks down starch; found in saliva.
Lipase	Breaks down fats in food.
Protease	Breaks down proteins in food.

Remember: most enzymes work on a specific reaction.

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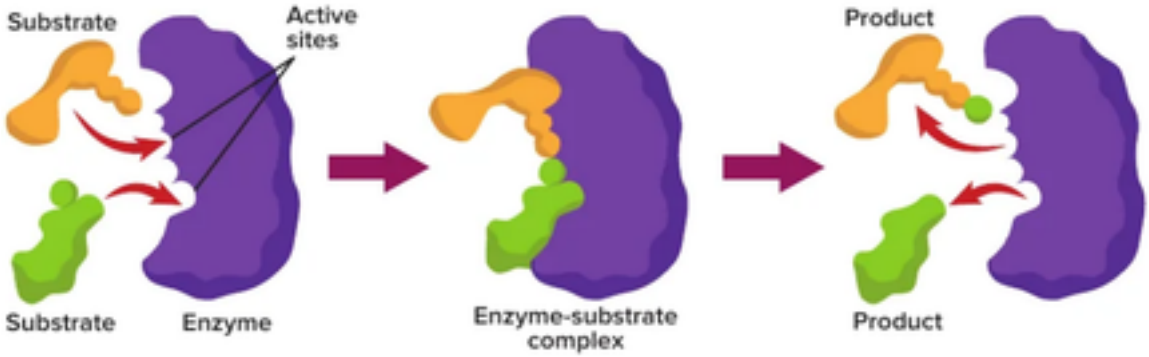
7. How an enzyme works

A shape that fits

The substrate is the reactant that binds to an enzyme. The active site is the specific place where binding occurs.

Specificity

Only substrates with a matching size and shape fit the active site, a little like puzzle pieces.



Textbook Figure 18 - enzyme-substrate interaction

Step-by-step

- 1. Binding: matching substrates reach the active site.
- 2. Complex: the active site changes shape and forms an enzyme-substrate complex.
- 3. Reaction: bonds break and new bonds form, creating products.
- 4. Release: products leave. The enzyme is free to work again.

Big connection

Enzymes help photosynthesis and cellular respiration, and also play roles in ripening fruit and other life processes.

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8. What affects enzyme activity?

Enzymes like the right conditions

Every enzyme works best at an optimal temperature and optimal pH. Activity falls when conditions move away from those levels.

1- Temperature

Most human-cell enzymes work best near 37°C. Enzymes from other organisms may differ.

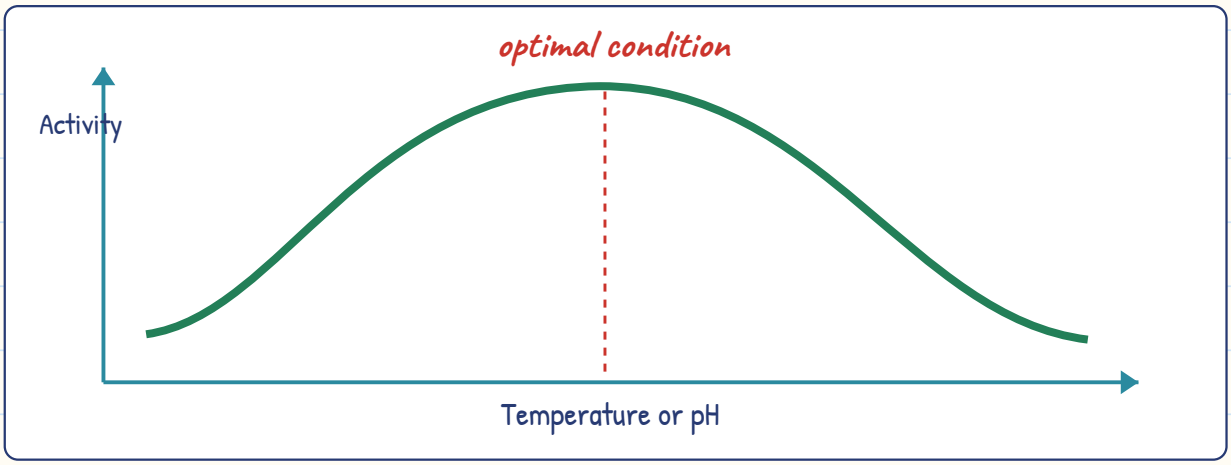
2- pH

The particular pH in blood 6.5- 7.5

Some stomach enzymes work in acidic conditions; other enzymes prefer different pH levels.

3- other substances

A simple activity curve



Inhibitors: things that slow enzymes down

Type	How it works
Active-site blocker	An inhibitor binds to the active site, so the substrate cannot attach.
Other-site inhibitor	It binds elsewhere and changes the active site shape.

The takeaway

Inhibitors can reduce enzyme activity or block it completely, even when substrate is available.

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9. Putting everything together

Vocabulary corner

Term	Quick meaning
Chemical reaction	Atoms rearrange; new substances form.
Reactants / products	Starting substances / substances formed.
Coefficient	Number in front of a chemical formula.
Activation energy	Minimum energy needed to start a reaction.
Exothermic	Releases energy; products have less energy.
Endothermic	Absorbs energy; products have more energy.
Catalyst	Speeds a reaction by lowering activation energy.
Enzyme	A biological catalyst (a protein).
Substrate / active site	Reactant / specific binding location on enzyme.
Inhibitor	Substance that reduces or blocks enzyme activity.

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The whole story in 4 ideas

- 1. Atoms rearrange: reactants become products.
- 2. Balanced equations conserve each element.
- 3. Reactions need activation energy and exchange energy.
- 4. Enzymes lower the energy barrier; conditions can affect them.

Focus question answered

Enzymes facilitate life by making essential reactions fast enough to support cells and organisms.

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Section review – multiple choice

Circle the best answer. Answers are on the last page.

1 Which statement best defines a chemical reaction?

A. A substance only changes its shape or state.
B. Atoms are rearranged and new substances are formed.
C. Matter is created from nothing.
D. All bonds stay exactly the same.

Section 1 review

2 In the equation A + B AB, which side contains the reactants?

A. The left side: A and B.
B. The right side: AB.
C. Both sides contain only products.
D. There are no reactants.

Section 1 review

3 Why must scientists balance chemical equations?

A. To show that heat is always released.
B. To make both sides look the same length.
C. To conserve the number of atoms of each element.
D. To remove all coefficients.

Section 1 review

4 What is activation energy?

A. Energy always released by a reaction.
B. The minimum energy needed to begin a reaction.
C. The energy stored in every product.
D. The energy of an active site.

Section 1 review

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Section review (continued)

Think about energy diagrams and catalysts.

5 Which comparison is correct?

A. Exothermic reactions absorb heat; endothermic reactions release it.

B. Exothermic products have more energy than reactants.

C. Exothermic releases energy; endothermic absorbs energy.

D. Neither reaction requires activation energy.

Section 1 review

6 What is the main role of an enzyme?

A. It increases activation energy.

B. It raises the amount of product made every time.

C. It is used up by the reaction.

D. It lowers activation energy and speeds the reaction.

Section 1 review

7 How does a substrate interact with an enzyme?

A. It can bind to any location on any enzyme.

B. It fits a specific active site, then products are released.

C. It always destroys the enzyme.

D. It must change the enzyme into a different protein.

Section 1 review

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Before the unit review

Try to explain these three ideas without looking: conservation of mass, activation energy, and active-site specificity.

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Unit review – Section 1

Vocabulary & main ideas (Q1–4)

1 Odd one out: reactant, product, activation energy. Why?

A. Reactant, because it is a substance.

B. Product, because it is always a gas.

C. Activation energy, because it is energy rather than a substance in the equation.

D. All three are substances.

Unit review

2 Which equation correctly balances glucose reacting with oxygen?

A. $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$

B. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

C. $C_6H_{12}O_6 + 6O_2 \rightarrow CO_2 + 6H_2O$

D. $6C_6H_{12}O_6 + O_2 \rightarrow 6CO_2 + H_2O$

Unit review

3 Which observation is evidence of a chemical rather than physical change?

A. Ice melting into water.

B. Water boiling into steam.

C. Iron reacting with oxygen to form rust.

D. Water being poured into a different container.

Unit review

4 What does the coefficient 6 in $6O_2$ tell you?

A. There are six oxygen molecules.

B. There are six different elements.

C. Oxygen has six protons.

D. There are six new kinds of products.

Unit review

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Unit review (continued)

Energy & catalysts (Q5–8)

5 Why does a candle need a match to begin burning?

A. A flame supplies the activation energy for the reaction.
B. The match removes all reactants.
C. The candle absorbs carbon dioxide as its only fuel.
D. No chemical reaction takes place.

Unit review

6 A cold pack becomes cold when activated. Which explanation fits?

A. It undergoes a reaction that must release energy.
B. It is exothermic and heats the surroundings.
C. It is endothermic and absorbs heat energy.
D. Its products always have lower energy than reactants.

Unit review

7 What changes when an enzyme catalyzes a reaction?

A. The starting and ending energy levels become the same.
B. The energy barrier becomes smaller.
C. The catalyst is completely consumed.
D. The reactants stop changing into products.

Unit review

8 Which statement about catalysts is correct?

A. They are used up after just one reaction.
B. They increase how much product can form.
C. They always raise activation energy.
D. They are reusable and can speed reactions.

Unit review

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Unit review (continued)

Enzyme action & factors (Q9–12)

9 Which enzyme and substrate are correctly matched?

A. Amylase – starch.
B. Lipase – proteins.
C. Protease – fats.
D. Amylase – iron oxide.

Unit review

10 Why do many human enzymes work best near 37 degrees C?

A. It is the temperature at which all chemicals freeze.
B. It is close to the optimum temperature for many human-cell enzymes.
C. No reactions occur above 37 degrees C.
D. All organisms have exactly the same enzyme optimum.

Unit review

11 An inhibitor binds at an enzyme s active site. What may happen?

A. The substrate can no longer bind at that site.
B. The enzyme must produce more product.
C. The substrate becomes a catalyst.
D. The temperature is instantly increased.

Unit review

12 Which sequence correctly describes enzyme action?

A. Product binds, enzyme is used up, substrate forms.
B. Enzyme is destroyed, then reactants appear.
C. Substrate binds, complex forms, products are released.
D. Inhibitor always becomes the final product.

Unit review

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Answer key

S = Section review U = Unit review

Q	Ans	Why?
S1	B	New substances form as atoms are rearranged.
S2	A	Reactants are written to the left of the arrow.
S3	C	The number of each element must be equal on both sides.
S4	B	Activation energy is the minimum energy required to start.
S5	C	Exothermic releases energy; endothermic absorbs it.
S6	D	Enzymes lower activation energy and speed reactions.
S7	B	Substrates match specific active sites; products leave.
U1	C	Activation energy is energy, not a chemical substance.
U2	B	6, 12 and 18 atoms of C, H and O balance on both sides.
U3	C	Rust is a new substance formed by a chemical reaction.
U4	A	A coefficient counts the molecules or formula units.
U5	A	The match flame provides activation energy.
U6	C	A cold pack is an endothermic example; it absorbs heat.
U7	B	The catalyst makes the activation-energy hill smaller.
U8	D	Catalysts can be used again and do not get used up.
U9	A	Amylase breaks down starch; lipase fats; protease proteins.
U10	B	Many human enzymes have an optimum near 37 degrees C.
U11	A	Blocking the active site prevents substrate binding.
U12	C	Substrate binding - complex - products are released.

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