CBSE CLASS X

Science (086)

ANSWER KEY

AI-generated question paper

Code: OFFFV9	Questions: 22	Maximum Marks: 45	Generated: 2026-06-25 12:59

SELECTIONS USED

Subject	Science
Lessons	1 Chemical Reactions and Equations
Level of understanding	Initial understanding
Question selection	Curated chapter coverage (~3 questions per section)
Model	claude-sonnet-4-6

Composition — Difficulty: 9 straightforward · 12 medium · 1 deep | Types: 15 Short · 5 Very short · 1 MCQ · 1 Long

Q1. straightforward · initial-understanding · § Chapter Introduction **[1]**

Which of the following is NOT a reliable indicator that a chemical reaction has taken place?
(A) Change in colour
(B) Change in shape
(C) Evolution of a gas
(D) Change in temperature

A Change in colour
B Change in shape
C Evolution of a gas
D Change in temperature

◆ **Chemical Reactions and Equations**

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Model Answer

(B) Change in shape

The textbook lists change in state, change in colour, evolution of a gas, and change in temperature as indicators of a chemical reaction — not change in shape.

Source: Chemical Reactions and Equations, Chapter 1 (Activity 1.1–1.3)

Explanation

The four recognised indicators of a chemical reaction (from the NCERT text) are: change in **state**, change in **colour**, evolution of a **gas**, and change in **temperature**. "Change in shape" is a physical change (e.g., cutting, moulding) and does not indicate a new substance has formed. Examiners expect you to recall this list exactly.

Q2. medium | initial-understanding | § Chapter Introduction **[2]**

When a magnesium ribbon is burned in air, a new substance is formed. (i) Name the substance formed. (ii) Is this change physical or chemical? Give one reason to justify your answer.

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Model Answer

(i) The substance formed when magnesium ribbon burns in air is **magnesium oxide (MgO)**.

$$\text{Magnesium} + \text{Oxygen} \rightarrow \text{Magnesium oxide}$$

(ii) This is a **chemical change**, because a new substance (magnesium oxide) is formed which has different properties from the original magnesium ribbon, and the change cannot be reversed.

Source: Chapter 1, Section 1.1 Chemical Equations

Explanation

- Part (i) is a direct recall fact — always name the product and write the word equation if space allows.
- Part (ii) needs a reason: the key indicator of a chemical change is **formation of a new substance** with different properties. Examiners also accept "irreversible change" as a valid reason. Avoid vague answers like "it looks different."

Q3. straightforward | initial-understanding | § 1.1 CHEMICAL EQUATIONS **[2]**

Why is it necessary to balance a chemical equation?

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Model Answer

A chemical equation must be balanced to satisfy the **law of conservation of mass**, which states that mass can neither be created nor destroyed in a chemical reaction. This means the number of atoms of each element must be equal on both the reactant side (LHS) and the product side (RHS) of the equation.

Source: Chapter 1, Section 1.1.2 Balanced Chemical Equations

Explanation

- The examiner expects two key points: (1) mention of the law of conservation of mass, and (2) equal number of atoms on both sides.
- Do **not** just say "atoms are equal" — name the law; that's where the marks are.
- One sentence on the law + one sentence on what it implies (equal atoms) = full 2 marks.

Q4. straightforward | initial-understanding | § 1.1.1 Writing a Chemical Equation **[2]**

Mg + O_2 → MgO is written using correct chemical formulae, yet it is not accepted as a complete chemical equation. Why not?

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Model Answer

The equation **Mg + O_2 → MgO** is only a **skeletal chemical equation**. It is unbalanced because the number of atoms of each element is not equal on both sides — there are 2 oxygen atoms on the LHS but only 1 on the RHS. According to the **law of conservation of mass**, a complete chemical equation must be balanced, with equal numbers of each type of atom on both sides.

The balanced equation is: **2Mg + O_2 → 2MgO**

Source: Chapter 1, Section 1.1.1 and 1.1.2

Explanation

Examiners award marks for two key points:

1. Identifying it as a **skeletal (unbalanced) equation** and stating *why* it is unbalanced (atom count mismatch).
2. Linking to the **law of conservation of mass** — this is the scientific reason a balanced equation is required.

Writing the correct balanced equation earns the second mark. Do not just say "it needs balancing" — show the atom counts or state the law explicitly.

Q5. straightforward | initial-understanding | § 1.1.2 Balanced Chemical Equations **[1]**

What law of nature makes it necessary to balance a chemical equation?

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Model Answer

The **Law of Conservation of Mass** makes it necessary to balance a chemical equation, as mass can neither be created nor destroyed in a chemical reaction.

Source: Chapter 1, Section 1.1.2 Balanced Chemical Equations

Explanation

Examiners expect the exact name of the law. You may add a one-line explanation (atoms of each element must be equal on both sides) to complete the answer. Do not write more than one sentence for a 1-mark question.

Q6. straightforward | initial-understanding | § 1.1.2 Balanced Chemical Equations **[1]**

Iron reacts with oxygen to form iron oxide. A student writes: $Fe + O_2 \rightarrow Fe_2O_3$. What term is used to describe this type of equation, and what is missing from it to make it chemically correct?

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Model Answer

It is a **skeletal chemical equation**; it is missing **balancing** — the number of atoms of each element is not equal on both sides.

Explanation

Examiners expect two things: the term "skeletal chemical equation" (unbalanced equation written using formulae) and the point that it needs to be balanced. The balanced equation is $4Fe + 3O_2 \rightarrow 2Fe_2O_3$. Both parts are needed for full credit.

Q7. medium | initial-understanding | § 1.1.2 Balanced Chemical Equations **[2]**

While balancing a chemical equation, why is it not allowed to change the formula of a compound — for example, writing H_2O_4 instead of placing the coefficient 4 in front of H_2O?

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Model Answer

Changing the formula of a compound (e.g., writing H_2O_4 instead of H_2O) would represent an entirely different substance that does not exist in the reaction. Each chemical formula is fixed and represents a specific compound with definite properties. To balance an equation, only **coefficients** (numbers placed in front of formulas) may be changed, so that the number of atoms of each element remains equal on both sides, satisfying the **Law of Conservation of Mass**.

Source: Chapter 1, Section 1.1.2 — Balanced Chemical Equations

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Explanation

- Examiners expect two clear points: (1) altering the formula changes the identity/composition of the substance, and (2) only coefficients are allowed because the law of conservation of mass must be satisfied without changing what substances are present.
- Quoting or referencing the textbook example ($H_2O \rightarrow 4H_2O$, not H_2O_4) shows you understand the rule directly from the source.
- Avoid writing a long paragraph; two crisp points earn full marks here.

Q8. medium | initial-understanding | § 1.1.2 Balanced Chemical Equations **[2]**

Balance the following chemical equation:
$Mg + O_2 \rightarrow MgO$
Write the balanced equation and state the ratio in which magnesium and oxygen combine.

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Model Answer

Balanced equation:

$$2Mg + O_2 \rightarrow 2MgO$$

Verification: LHS — Mg: 2, O: 2 | RHS — Mg: 2, O: 2 ✓

Ratio of combination: Magnesium and oxygen combine in the ratio **2 : 1** (in terms of number of molecules/moles).

Source: Chapter 1, Section 1.1.2 Balanced Chemical Equations

Explanation

- The skeletal equation $Mg + O_2 \rightarrow MgO$ is unbalanced (2 O on left, 1 O on right). Place coefficient 2 before both Mg and MgO to balance all atoms.
- Examiners award **1 mark** for the correct balanced equation and **1 mark** for stating the correct ratio (2 Mg : 1 O_2).
- Never change subscripts to balance; only add coefficients in front of formulae.

Q9. straightforward | initial-understanding | § 1.1.2 Balanced Chemical Equations **[2]**

In a balanced chemical equation, state symbols are used alongside the formulae of substances. What do the symbols (s), (l), (g), and (aq) represent? Why is it important to include these symbols in a chemical equation?

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Model Answer

The state symbols represent the physical states of substances in a reaction:

- **(s)** – solid
- **(l)** – liquid
- **(g)** – gaseous
- **(aq)** – aqueous (substance dissolved in water)

Including these symbols makes a chemical equation more informative by showing the physical state of each reactant and product, giving a complete picture of the reaction.

Source: Chapter 1, Section 1.1.2 (Step VII – Writing Symbols of Physical States)

Explanation

- Examiners expect all four symbols defined clearly — losing even one definition can cost half a mark.
- The second part (why important) is often missed; the key phrase from the textbook is **"more informative"** — state symbols tell us *how* each substance is present in the reaction.
- Remember: **(aq)** specifically means dissolved **in water**, not just any solution.

Q10. deep | initial-understanding | § 1.1.2 Balanced Chemical Equations **[5]**

A student writes the following equation for the reaction between iron and steam:
Fe + H_2O → Fe_3O_4 + H_2
(a) Explain why this equation is considered unbalanced.
(b) Write the fully balanced chemical equation for this reaction, including state symbols.

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Model Answer

(a) Why the equation is unbalanced:

The given equation $Fe + H_2O \rightarrow Fe_3O_4 + H_2$ is unbalanced because the number of atoms of each element is **not equal** on both sides, violating the Law of Conservation of Mass.

Element	LHS	RHS
Fe	1	3
O	1	4
H	2	2

Since Fe and O atoms differ on LHS and RHS, the equation is a skeletal (unbalanced) chemical equation.

(b) Fully balanced equation with state symbols:

Using the hit-and-trial method — balance O first (coefficient 4 for H_2O), then H (coefficient 4 for H_2), then Fe (coefficient 3):

$$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$$

The state symbol (g) is used for H_2O because water is used as steam in this reaction.

Source: Chapter 1, Sections 1.1.1 and 1.1.2

Explanation

- **(a)** Examiners expect you to explicitly count atoms of each element on both sides and show the mismatch in a table. Simply saying "it's not balanced" without evidence will lose marks.
- **(b)** Always include state symbols when asked — (s) for Fe and Fe_3O_4, **(g) for H_2O (steam)**, and (g) for H_2. Forgetting (g) for steam is a common error. The balanced coefficients 3, 4, 1, 4 are the key numbers to remember.
- The method used here is the **hit-and-trial method** — start with the compound having the most atoms (Fe_3O_4), balance O → H → Fe in that order.

Q11. medium | initial-understanding | § 1.2 TYPES OF CHEMICAL REACTIONS **[2]**

Iron nails are immersed in copper sulphate solution. After some time, the blue colour of the solution begins to fade. What type of chemical reaction is taking place? Identify the substance that gets displaced in this reaction and give a reason for your answer.

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Model Answer

This is a **displacement reaction**.

Copper (Cu) is the substance that gets displaced.

Reaction: $\mathrm{Fe}(s) + \mathrm{CuSO_4}(aq) \rightarrow \mathrm{FeSO_4}(aq) + \mathrm{Cu}(s)$

Iron displaces copper because iron is more reactive than copper. It removes copper from copper sulphate solution, forming iron sulphate; hence the blue colour of the solution fades.

Source: Chapter 1, Section 1.2.3 – Displacement Reaction

Explanation

- **1 mark** for correctly naming the reaction type (displacement reaction).
- **1 mark** for identifying copper as the displaced substance AND giving the reason (iron is more reactive than copper).
- Writing the balanced equation is a strong supporting point and shows clarity — examiners appreciate it even if not explicitly demanded.
- Do **not** say iron is displaced; iron does the displacing, copper is displaced.

Q12. straightforward | initial-understanding | § 1.2.1 Combination Reaction **[1]**

When calcium oxide is added to water, is heat released or absorbed? What type of reaction (in terms of energy) does this represent?

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Model Answer

Heat is **released**. This represents an **exothermic reaction**, as heat is evolved along with the formation of the product (slaked lime).

Source: Chapter 1, Section 1.2.1 – Combination Reaction

Explanation

For a 1-mark question, examiners award the mark for correctly stating either that heat is released **or** that it is an exothermic reaction — ideally mention both in one line. The key term is **exothermic**; do not write "endothermic" (which is when energy is absorbed). The reaction CaO + H2O → Ca(OH)2 + Heat is the standard example of an exothermic combination reaction in this chapter.

Q13. medium | initial-understanding | § 1.2.1 Combination Reaction **[2]**

Burning of coal can be represented as C + O_2 → CO_2, and hydrogen reacting with oxygen produces water ($2H_2 + O_2 \rightarrow 2H_2O$). What type of chemical reaction do both of these represent, and what common feature of the two reactions leads you to this classification?

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Model Answer

Both reactions — C + O_2 → CO_2 and $2H_2 + O_2 \rightarrow 2H_2O$ — represent **combustion reactions**, which are a type of **oxidation (exothermic) reaction**.

Common feature: In both reactions, a substance (carbon/hydrogen) combines with oxygen and releases heat and light energy. This gain of oxygen by the substance is called oxidation, making both reactions exothermic combustion reactions.

Source: Chapter 1 (Types of Chemical Reactions); Chapter 4, Section 4.3.1 (Combustion)

Explanation

- Examiners expect students to name the reaction type correctly — **combustion/oxidation** — for 1 mark.
- The second mark is for identifying the **common feature**: both involve combination with oxygen, releasing heat and light (exothermic).
- Avoid writing just "combination reaction" — combustion is the specific and more accurate term here; also note it is a type of oxidation.
- Mentioning "heat and light released" strengthens the answer.

Q14. straightforward | initial-understanding | § 1.2.2 Decomposition Reaction **[1]**

When lead nitrate is heated strongly, brown fumes are produced along with a solid residue and oxygen gas. What are the brown fumes, and what is the solid residue formed?

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Model Answer

The brown fumes are **nitrogen dioxide (NO_2)**. The solid residue formed is **lead oxide (PbO)**.

Explanation

The reaction is: $2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + 4NO_2 + O_2$. Examiners expect both products named correctly. One mark is typically split: ½ for NO_2, ½ for PbO — so both must be stated.

Source: Chapter 1, Section 1.2.2 (Activity 1.6)

Q15. medium | initial-understanding | § 1.2.2 Decomposition Reaction **[3]**

Decomposition reactions can be driven by different forms of energy. Name the forms of energy that can cause decomposition reactions and give one example of a decomposition reaction for any one of them.

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Model Answer

Decomposition reactions can be driven by three forms of energy:

1. **Heat (Thermal decomposition)**
2. **Light (Photolytic decomposition)**
3. **Electricity (Electrolytic decomposition)**

Example (Heat):

$$2FeSO_4(s) \xrightarrow{\Delta} Fe_2O_3(s) + SO_2(g) + SO_3(g)$$

Ferrous sulphate decomposes on heating to give ferric oxide, sulphur dioxide and sulphur trioxide.

Source: Chapter 1 – Chemical Reactions and Equations

Explanation

- The question has two parts: **name** the energy forms (1 mark each, total 2 marks) and **give one example** (1 mark). Name all three forms clearly.
- Any valid equation for heat, light, or electricity is acceptable. Common choices: heat → $FeSO_4$ or $CaCO_3$; light → AgCl or AgBr; electricity → H_2O electrolysis.
- Write the equation with state symbols and the energy symbol (Δ or *hν*) above the arrow for full marks.
- Examiners award 1 mark for each correctly named energy form and 1 mark for a correct balanced equation with appropriate energy indicated.

Q16. medium | initial-understanding | § 1.2.2 Decomposition Reaction **[2]**

White silver chloride turns grey when left in sunlight. What type of reaction is this, and what products are formed?

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Model Answer

This is a **photochemical decomposition reaction**. Silver chloride decomposes in the presence of sunlight to form silver metal and chlorine gas.

$$2AgCl \xrightarrow{\text{Sunlight}} 2Ag + Cl_2$$

The silver formed gives the white AgCl its grey colour.

Source: Chapter 1, Chemical Reactions and Equations

Explanation

- **1 mark** for correctly identifying it as a photochemical decomposition reaction.
- **1 mark** for the correct products: silver (Ag) and chlorine (Cl_2), ideally with the balanced equation.
- CBSE expects the word "decomposition" and the qualifier "photochemical" (sunlight-driven). Simply writing "decomposition" without the photochemical context may lose half a mark.
- The equation is a strong addition and shows clarity; always write it when you can within the word limit.

Q17. medium | initial-understanding | § 1.2.2 Decomposition Reaction **[2]**

Decomposition reactions are described as endothermic. What does the term 'endothermic' mean? Explain why decomposition reactions require an external supply of energy to proceed.

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Model Answer

Endothermic means a reaction in which energy is **absorbed** from the surroundings.

In decomposition reactions, a single substance breaks down into two or more substances. Breaking the chemical bonds in the reactant requires energy. Since energy must be supplied (as heat, light, or electricity) to break these bonds, decomposition reactions are endothermic.

Source: Chemical Reactions and Equations, Chapter 1 — What you have learnt

Explanation

- **1 mark** for correctly defining endothermic (energy is absorbed).
- **1 mark** for explaining that bond-breaking in the reactant requires an external energy input, linking it specifically to decomposition reactions.
- Examiners expect you to contrast with exothermic (energy released) implicitly by using precise language like "absorbed."
- Avoid vague phrases like "needs energy to work" — say *bonds must be broken* and *energy is absorbed from surroundings*.

Q18. medium | initial-understanding | § 1.2.3 Displacement Reaction **[3]**

When iron nails are dipped in copper sulphate solution, the blue colour of the solution gradually fades. What type of chemical reaction is this? Give a reason for the change in colour.

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Model Answer

This is a **displacement reaction**.

Chemical equation:

$$\mathrm{Fe}(s) + \mathrm{CuSO_4}(aq) \rightarrow \mathrm{FeSO_4}(aq) + \mathrm{Cu}(s)$$

Reason for colour change: Iron is more reactive than copper, so it displaces copper from copper sulphate solution. The blue colour of copper sulphate ($CuSO_4$) gradually fades because it is converted into iron sulphate ($FeSO_4$), which is pale green/colourless. Copper gets deposited on the iron nail, turning it brownish.

Source: Chapter 1, Section 1.2.3 – Displacement Reaction

Explanation

- **1 mark** for naming the reaction type (displacement reaction).
- **1 mark** for the balanced chemical equation.
- **1 mark** for the reason — iron displaces copper because it is more reactive; $CuSO_4$ (blue) is converted to $FeSO_4$ (colourless/pale green), causing the blue colour to fade.
- Always write the chemical equation in a displacement reaction answer — examiners expect it.
- Don't forget to mention *why* the colour fades (the product $FeSO_4$ is not blue).

Q19. medium | initial-understanding | § 1.2.4 Double Displacement Reaction **[3]**

When sodium sulphate solution is mixed with barium chloride solution, an insoluble white solid settles at the bottom of the test tube. What type of chemical reaction is this?

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Model Answer

This reaction is a **double displacement reaction** (also called a **precipitation reaction**).

When sodium sulphate solution is mixed with barium chloride solution, the ions exchange between the two reactants. The sulphate ions (SO_4^{2-}) and barium ions (Ba^{2+}) combine to form an insoluble white precipitate of barium sulphate ($BaSO_4$), while sodium chloride remains in solution.

$$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$$

The insoluble solid formed is called a **precipitate**, and any reaction that produces a precipitate is called a **precipitation reaction**. Since there is an exchange of ions between the reactants, it is a double displacement reaction.

Source: Chapter 1, Section 1.2.4 Double Displacement Reaction

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Explanation

- **3 marks** are typically split as: (1) correct name of reaction type, (1) reason/explanation of ion exchange, (1) correct balanced equation.
- Always write the balanced chemical equation with state symbols — examiners specifically look for **(s)**, **(aq)** etc.
- Mention **both** names — "double displacement" AND "precipitation reaction" — to be safe, as either may be the expected answer.
- The key distinguishing feature of a double displacement reaction is **exchange of ions** between the two reactants.

Q20. medium | initial-understanding | § 1.2.5 Oxidation and Reduction **[3]**

When copper(II) oxide reacts with hydrogen gas, copper and water are formed. Which substance is oxidised and which is reduced in this reaction? Give a reason for each.

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Model Answer

The reaction is: $\mathrm{CuO} + \mathrm{H_2} \xrightarrow{\text{Heat}} \mathrm{Cu} + \mathrm{H_2O}$

Hydrogen is oxidised — because it gains oxygen (to form water).

Copper(II) oxide is reduced — because it loses oxygen (to form copper).

This is a redox reaction, where oxidation and reduction occur simultaneously.

Source: Chapter 1, Section 1.2.5 — Oxidation and Reduction

Explanation

- Examiners award **1 mark for the equation**, **1 mark for identifying the oxidised substance with reason**, and **1 mark for identifying the reduced substance with reason**.
- The key definitions to apply: *gain of oxygen = oxidised; loss of oxygen = reduced*.
- Always write the balanced equation first — it shows you clearly which substance gains and which loses oxygen.
- Do not confuse: CuO is **reduced** (it gives away oxygen), H_2 is **oxidised** (it receives oxygen). A common mistake is to reverse these.

Q21. straightforward | initial-understanding | § 1.2.5 Oxidation and Reduction **[1]**

A substance gains oxygen during a chemical reaction. Is it oxidised or reduced?

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Model Answer

A substance that **gains oxygen** during a chemical reaction is **oxidised**. (Oxidation is defined as the gain of oxygen or loss of hydrogen.)

Explanation

The definition directly from Chapter 1 states: "Oxidation is the gain of oxygen or loss of hydrogen." Examiners expect the one-word answer *oxidised* plus its definition for full marks. Don't confuse oxidation with reduction (which is the *loss* of oxygen).

Q22. medium | initial-understanding | § 1.3 HAVE YOU OBSERVED THE EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE? **[2]**

Chips manufacturers flush packets with nitrogen gas before sealing them. What problem does this prevent, and why does nitrogen help?

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Model Answer

Chips manufacturers flush packets with nitrogen gas to **prevent oxidation (rancidity)** of the chips. Oxygen in air causes the chips to turn stale and spoil quickly. Nitrogen is used because it is a chemically **inert (non-reactive) gas** — it does not react with the food, keeping the chips fresh while also preventing the packet from being crushed.

Explanation

This question draws on the concept of chemical reactivity of gases (from Chapter 4, Carbon and its Compounds context — inert gases). Key points examiners look for: (1) naming the problem — oxidation/rancidity, (2) explaining why nitrogen helps — it is inert/non-reactive. Avoid writing lengthy explanations; two clear points are enough for 2 marks.

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