

Final Exam Review

NCDPI

North Carolina Test of Chemistry, Form A RELEASED Fall 2009

Name Key

1. How many protons and electrons are in a ${}^{64}_{29}\text{Cu}^{2+}$ ion?

~~A~~ 27 protons, 29 electrons

~~B~~ 27 protons, 31 electrons

C 29 protons, 27 electrons

D 29 protons, 31 electrons

2. What is the name of the compound with the chemical formula CrCl_3 ?

A chromium tetrachloride

B chromium trichloride

C chromium(II) chloride

D chromium(III) chloride

3. If two oxygen atoms combine to make a molecule, what type of bond will they form?

A an ionic bond

B a hydrogen bond

C a double covalent bond

D a metallic bond

4. Why did most of the alpha particles go straight through the gold foil in Rutherford's experiment?

A Most of an atom is empty space.

B Alpha particles are positively charged.

C Alpha particles move with high velocity.

D The center of an atom is positively charged.

5. How does an S^{2-} ion differ from an electrically neutral sulfur atom?

A mass number

B atomic number

C nuclear charge

D number of electrons

6. A gas under a pressure of 74 mmHg and at a temperature of 75°C occupies a 500.0-L container. How many moles of gas are in the container?

A 1.7 moles

B 7.9 moles

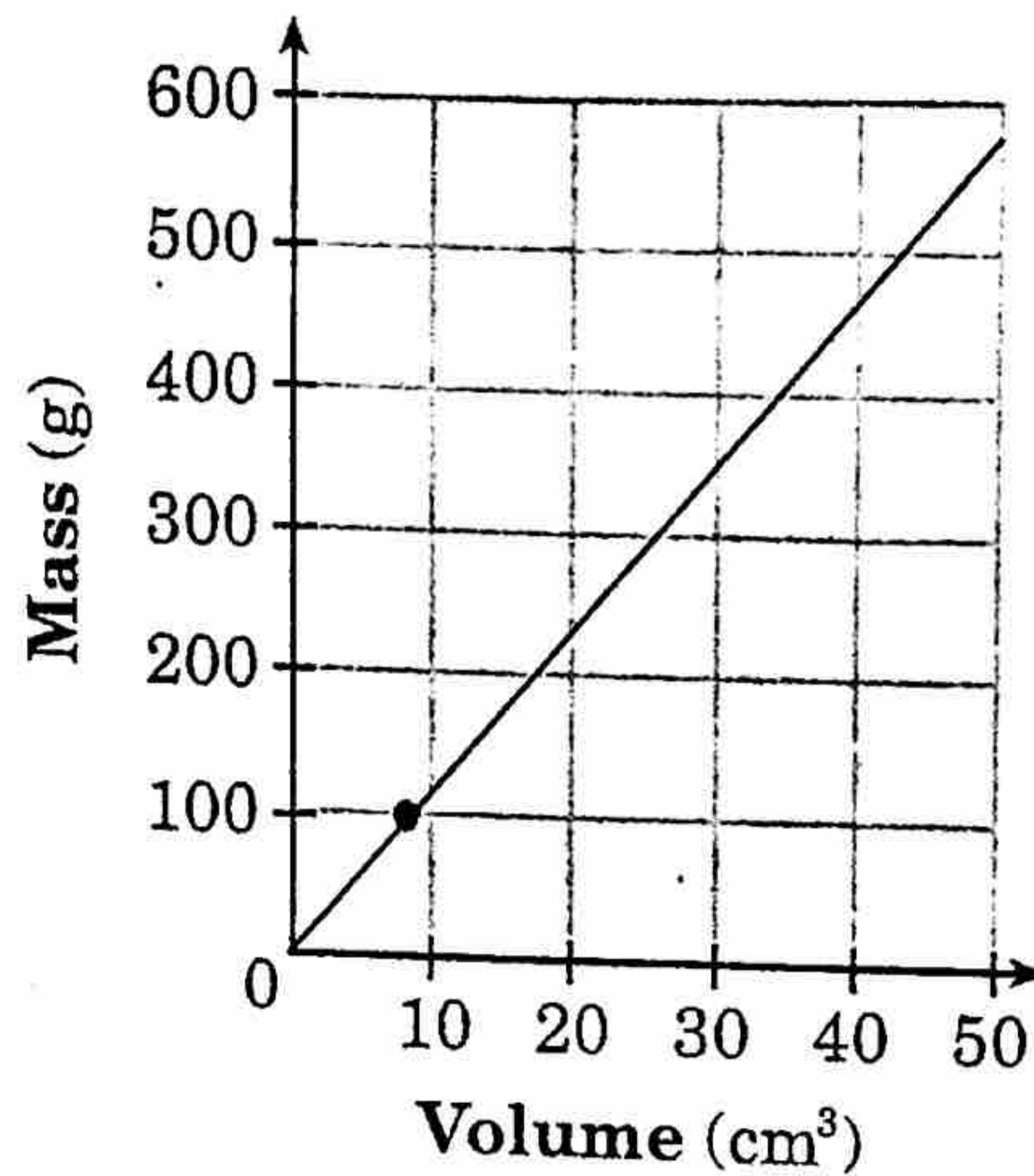
C 13 moles

D 59 moles

$$PV = nRT$$
$$(74\text{mmHg})(500.0\text{L}) = x(62.4)(348)$$
$$x = 1.7$$

7. A chemistry student is given 5 samples of a metal. The student measures and records the mass and the volume of each sample and then graphs the data, as shown below.

Mass vs. Volume of a Metal

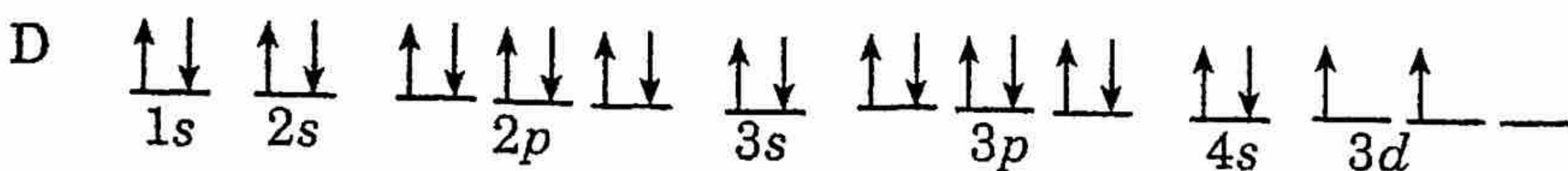
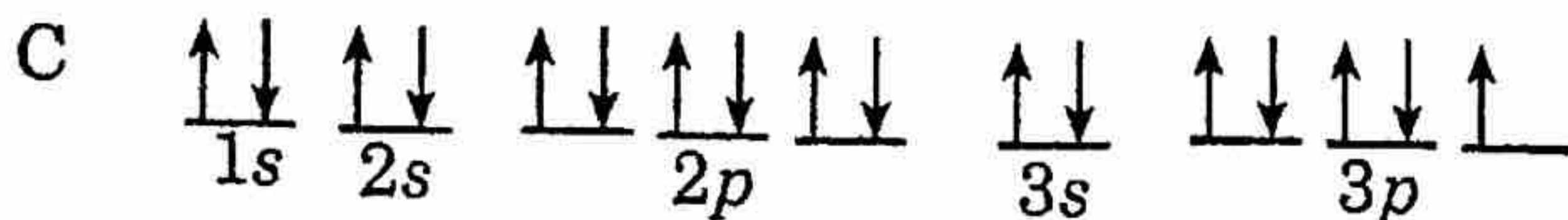
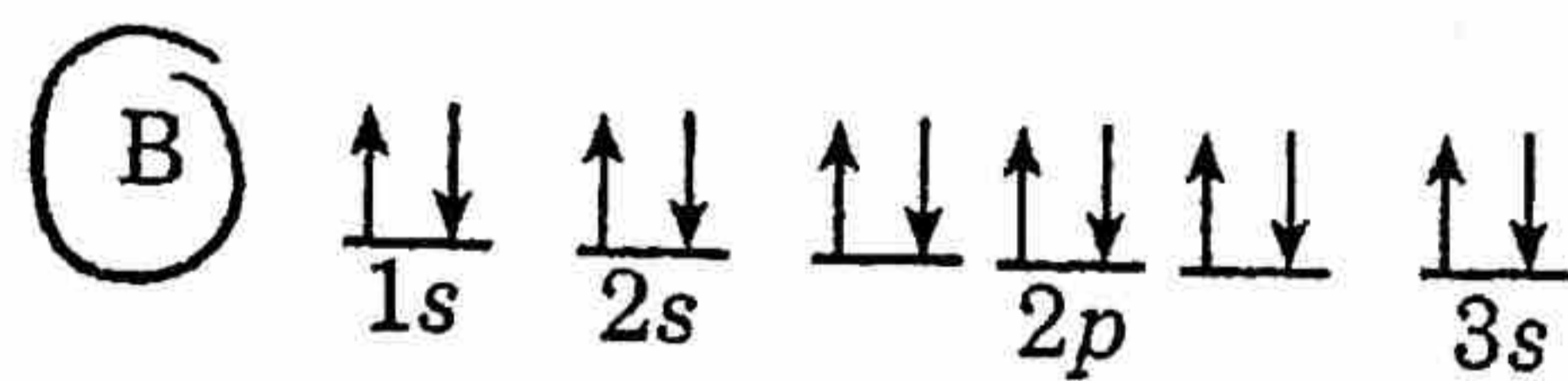
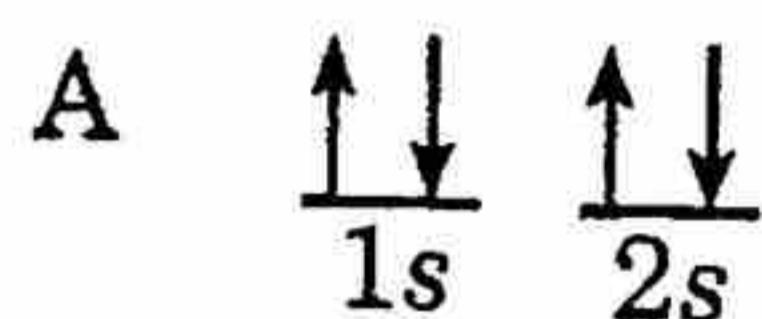


What is the identity of the metal?

- A aluminum
- B iron
- C nickel
- D lead

$$D = \frac{m}{V} = \frac{100g}{9cm^3} = 11.1g/cm^3$$

8. Which orbital notation represents an s-block element in the third period?



9. What is the volume of 2.00 moles of nitrogen gas (N_2) at STP?

A 11.2 L

B 28.0 L

C 44.8 L

D 56.0 L

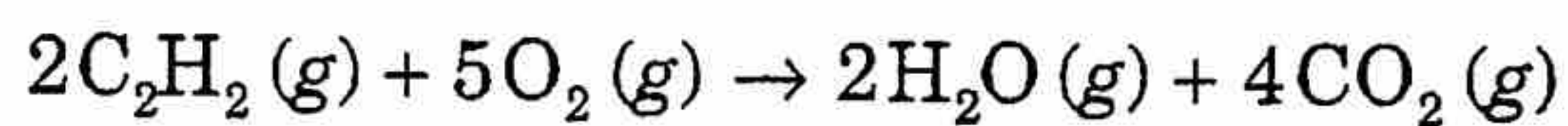
$$PV = nRT \quad \text{or}$$

$$(1 \text{ atm})(x) = (2)(0.0821)(273)$$

$$x = 44.8 \text{ L}$$

$$\frac{2.00 \text{ mol}}{1 \text{ mol}} \left| \frac{22.4 \text{ L}}{1 \text{ mol}} \right.$$

10. According to this balanced chemical equation, what volume of C_2H_2 is required to form 40.0 L of CO_2 ?



A 20.0 L

B 44.8 L

C 80.0 L

D 100 L

$$\frac{40.0 \text{ L } CO_2}{22.4 \text{ L } CO_2} \left| \frac{1 \text{ mol } CO_2}{4 \text{ mol } CO_2} \right| \left| \frac{2 \text{ mol } C_2H_2}{1 \text{ mol } C_2H_2} \right| \left| \frac{22.4 \text{ L } C_2H_2}{1 \text{ mol } C_2H_2} \right.$$

11. In an experiment, 2.62 g of iron react completely with 1.50 g of sulfur. What is the empirical formula for the compound produced?

- A FeS
 B FeS₂
 C Fe₂S
 D Fe₂S₃

$$\frac{2.62 \text{ g Fe}}{55.85 \text{ g Fe}} \times \frac{1 \text{ mol Fe}}{1} = 0.0469 / 0.0468 = 1$$

$$\frac{1.50 \text{ g S}}{32.07 \text{ g S}} \times \frac{1 \text{ mol}}{1} = 0.0468 / 0.0468 = 1$$

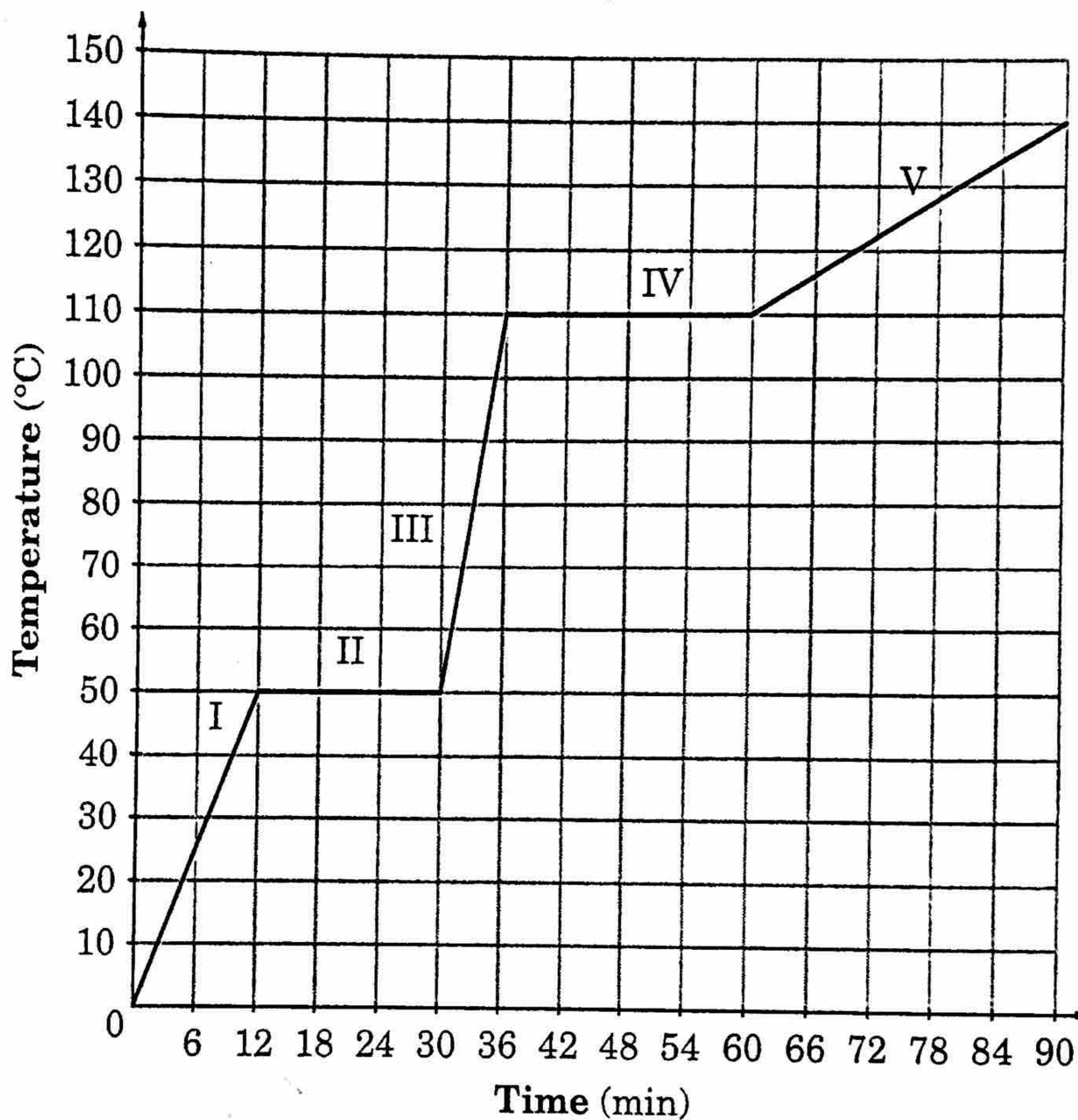
FeS

12. What do the ions K⁺, Ca²⁺, and Cl⁻ have in common?

- A They have the same number of protons.
 B They will form covalent bonds with oxygen.
 C They have the same electron configuration as argon.
 D They are larger than their corresponding atoms.

13. This graph represents a heating curve of a substance.

Heating Curve



A

Which region on the graph represents the solid phase?

- A I
- B II
- C III
- D IV

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14. When $^{42}_{19}\text{K}$ undergoes radioactive decay, the result is two products, one of which is calcium-42. What is the other product?

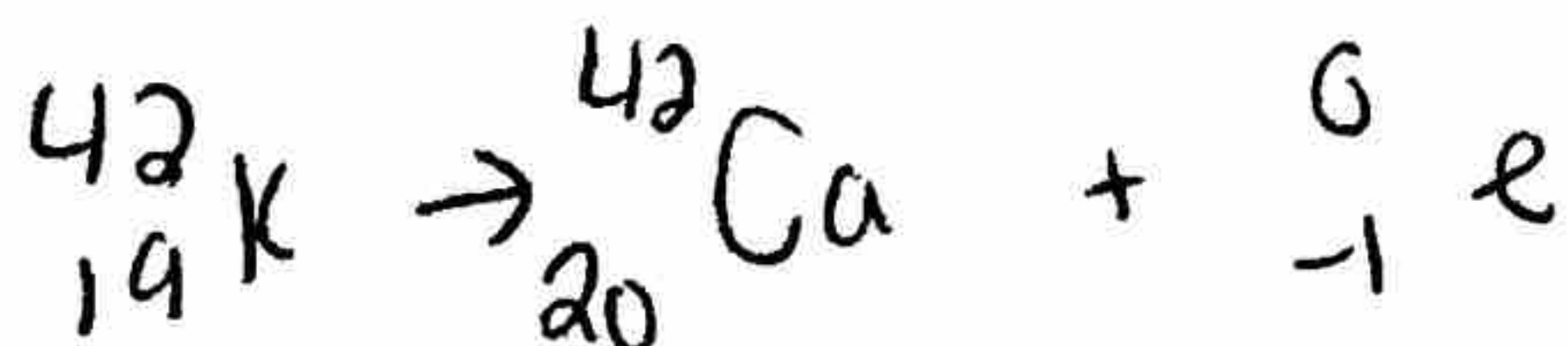
A ^4_2He

B ^2_4He

C ^1_1e

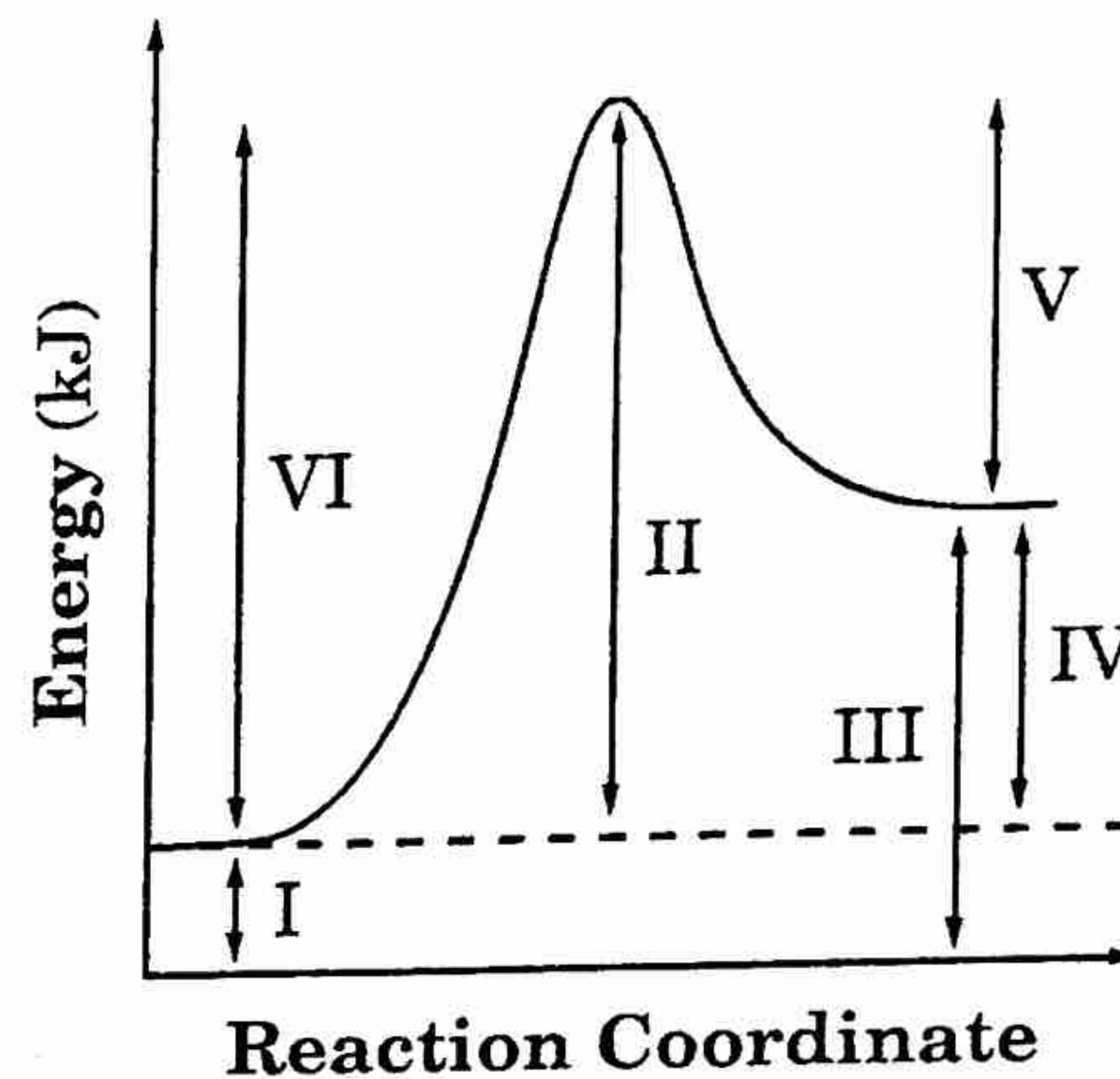
D $^0_{-1}\text{e}$

D



15. This graph is a potential energy diagram for a chemical reaction.

Potential Energy Diagram

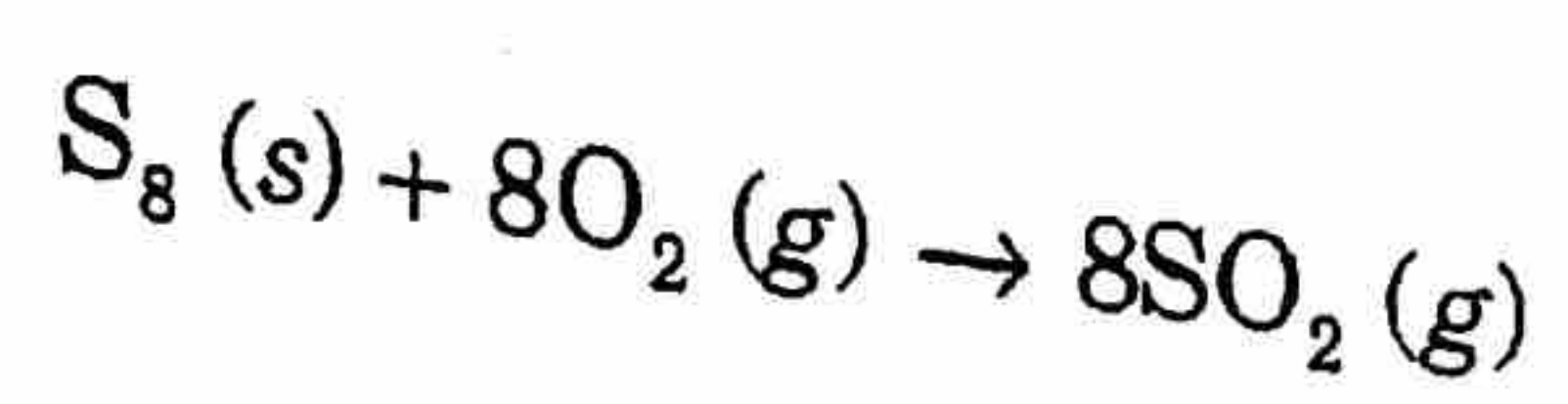


B

Which energy measure will remain unchanged with the addition of a catalyst?

- ~~A~~ II
- B** IV
- ~~C~~ V
- ~~D~~ VI

16. What type of chemical reaction is represented by this balanced equation?



- A synthesis
- B decomposition
- C single replacement
- D double replacement

17. Which chemical equation is balanced?

- ~~A~~ $LiOH + CO_2 \rightarrow Li_2CO_3 + H_2O$
- B $2LiOH + CO_2 \rightarrow Li_2CO_3 + H_2O$
- ~~C~~ $LiOH + 3CO_2 \rightarrow 2Li_2CO_3 + H_2O$
- ~~D~~ $4LiOH + CO_2 \rightarrow Li_2CO_3 + 2H_2O$

18. Neutralization occurs when 15.0 mL of KOH react with 25.0 mL of HNO₃. If the molarity of HNO₃ is 0.750 M, what is the molarity of the KOH?

- A 1.67 M
- B 1.25 M
- C 0.600 M
- D 0.450 M

$n_A M_A V_A = n_B M_B V_B$

$(1)(.750M)(25.0mL) = (1)(x)(15.0mL)$

$x = 1.25 M$

19. Which substance can act as either an acid or a base according to the Brønsted-Lowry definition?

- A H₃O¹⁺
- B NH₄¹⁺
- C HOH
- D HCl

20. What is the oxidation number of sulfur in BaSO₄?

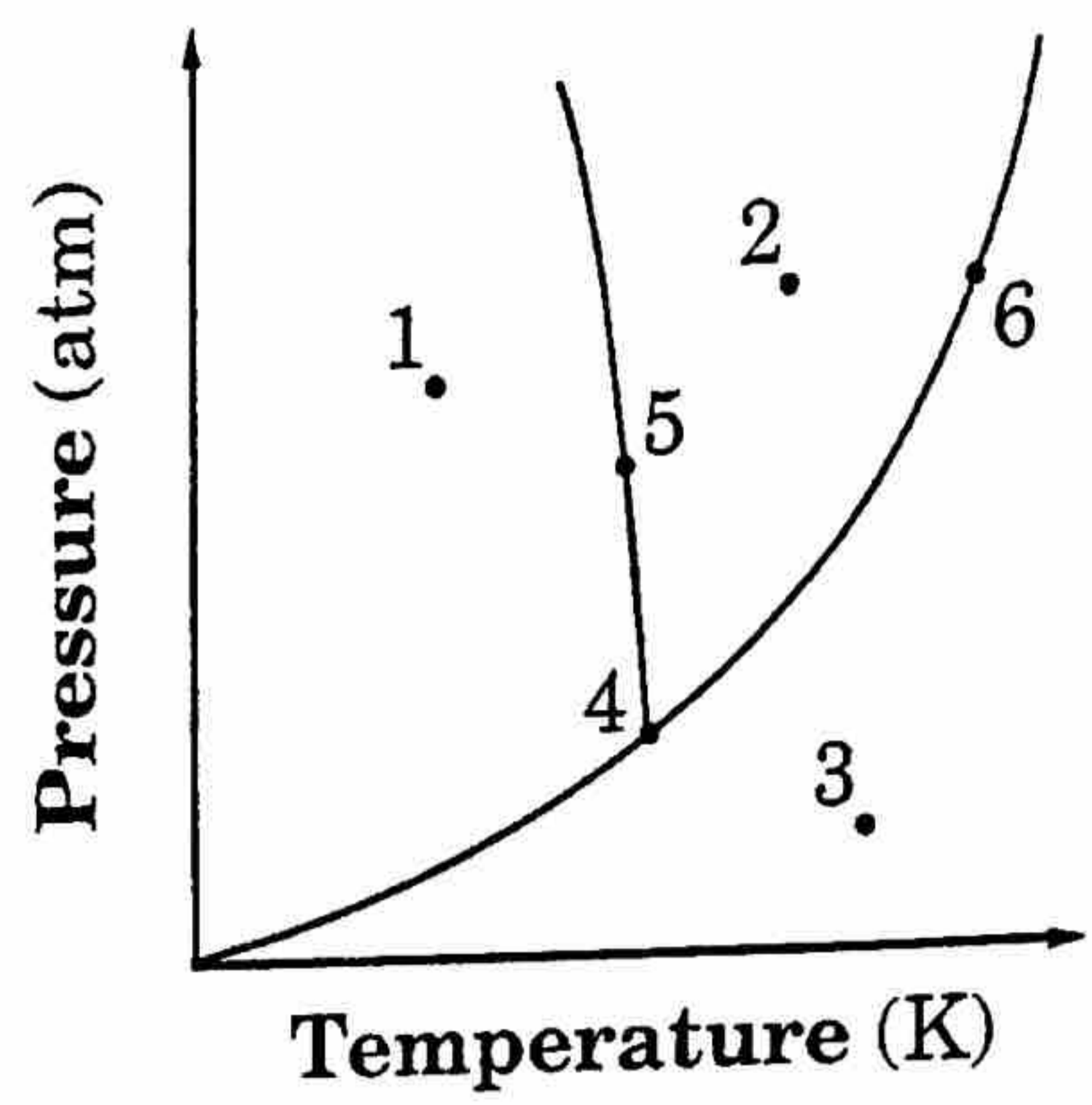
- A -2
- B 0
- C +1
- D +6

can think of as charge

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21. This diagram represents a phase diagram for a substance.

Phase Diagram

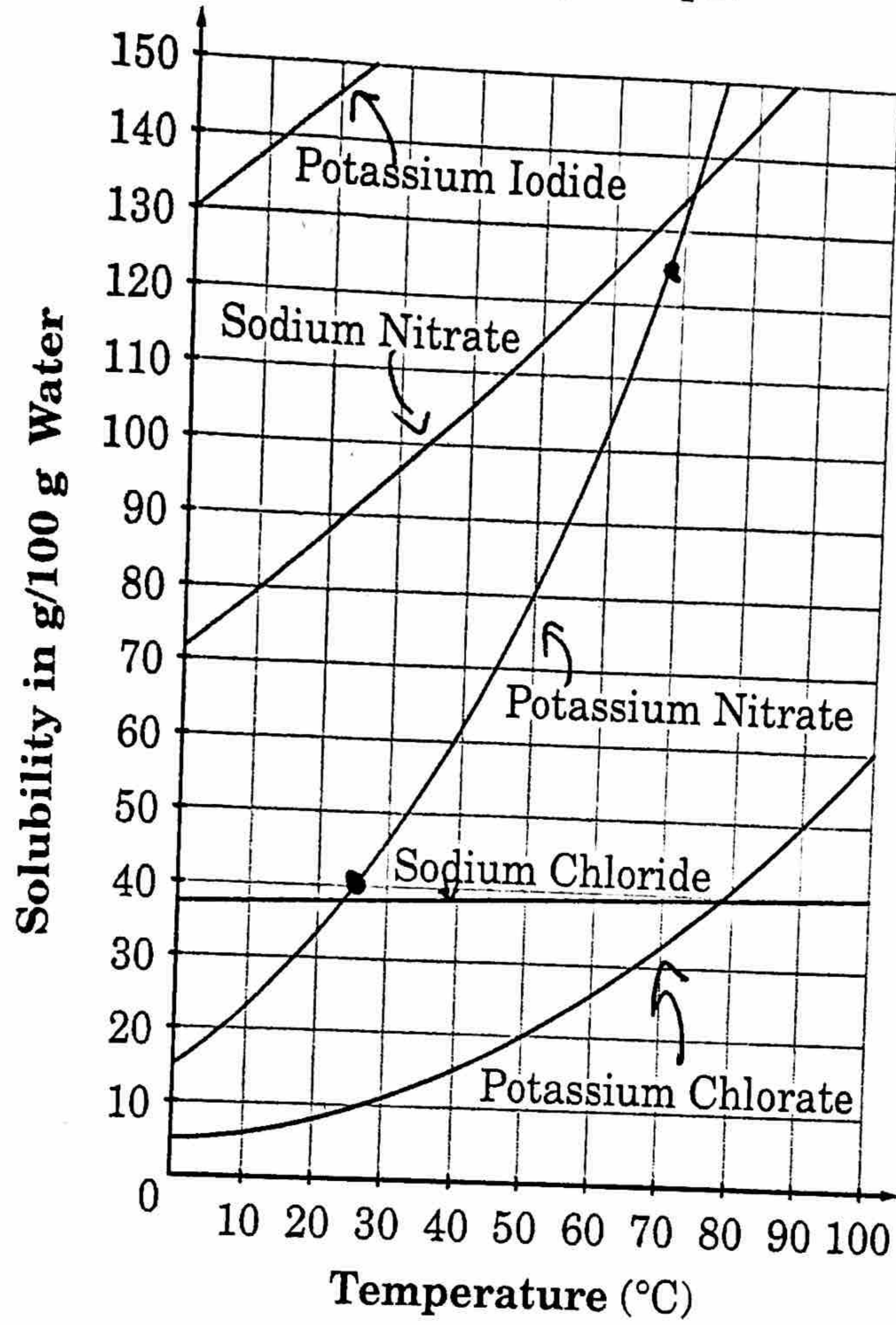


At which point do solid, liquid, and gas phases exist in equilibrium?

- A 1
- B 2
- C 3
- D 4**

22. Using the solubility graph provided, a student performs an experiment to find the solubility of a substance. The student finds the amount of substance needed to make a saturated solution in 100 g of water at different temperatures. The student's data are shown in the table below the graph.

Solubility Graph



Student Data

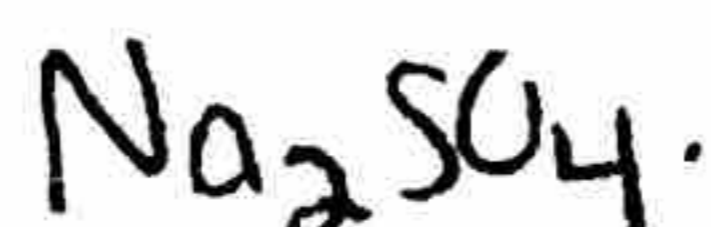
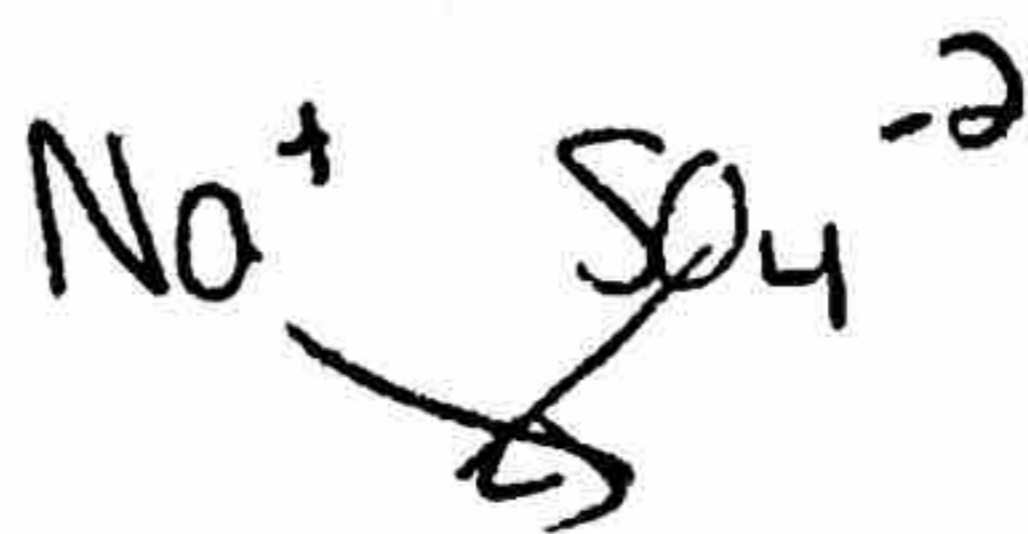
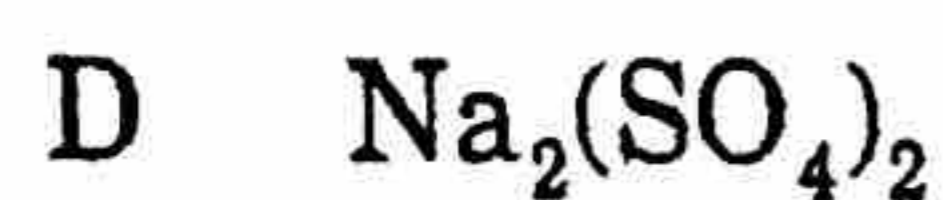
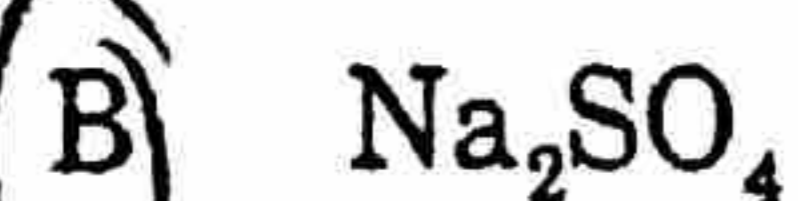
Trial	Temperature (°C) of Water	Salt in 100 g of water (g)
1	25	40
2	68	126

What is the identity of the substance?

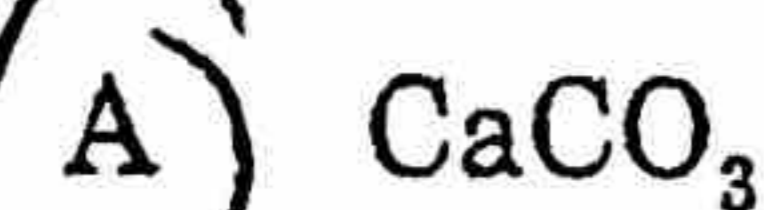
- A Sodium Nitrate
- B Potassium Nitrate
- C Sodium Chloride
- D Potassium Chlorate

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23. What is the correct chemical formula for sodium sulfate?



24. Which compound contains both covalent and ionic bonds?



to have both
need to have
a cation + anion,
one needs to
be a polyatomic
ion

25. In a flexible container, 15.9 L of gas is under 589 kPa of pressure at a temperature of 56.5°C. If the pressure and temperature change to STP, what is the new volume?

A 10.2 L

B 76.6 L

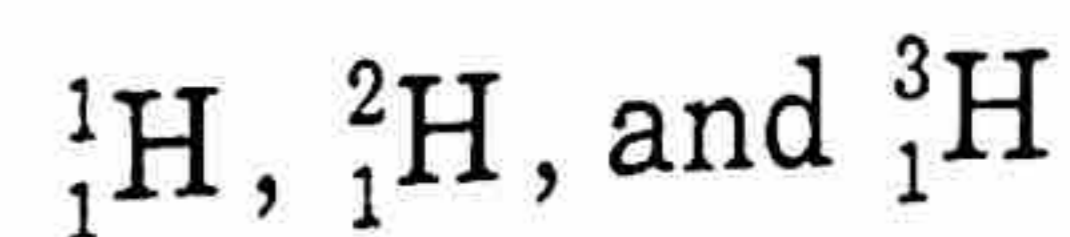
C 92.4 L

D 112 L

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{(589 \text{ kPa})(15.9 \text{ L})}{329.5 \text{ K}} = \frac{(101.3 \text{ kPa})(x)}{273 \text{ K}}$$

26. What are the differences between these isotopes of hydrogen shown below?



A the number of electrons and the atomic number

B the number of protons and the atomic number

C the number of neutrons and the mass number

D the number of electrons and protons

27. What is the correct name for the acid whose chemical formula is H_2SO_4 ?

A hydrosulfuric acid

B hydrosulfurous acid

C sulfurous acid

D sulfuric acid

28. Which element is located in Group 2 (IIA) and Period 6 of the periodic table?

A barium (Ba)

B molybdenum (Mo)

C radium (Ra)

D tungsten (W)

29. How many moles are in 325 g of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$?

- A 0.732 mole
- B 0.776 mole
- C 1.29 moles**
- D 1.37 moles

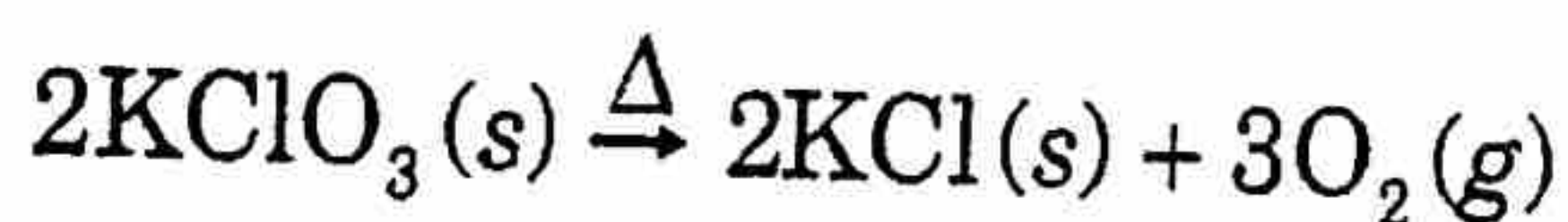
$$\frac{325 \text{ g}}{252.064 \text{ g}} \times 1 \text{ mol} = 1.29$$

30. Which compound contains the greatest percent of oxygen by mass?

- A $\text{CO}_2 = 72.7\%$**
- B $\text{NO}_2 = 69.6\%$
- C $\text{SO}_2 = 49.9\%$
- D $\text{SiO}_2 = 53.3\%$

$$\frac{\% \text{ oxygen}}{\text{Compound}} \times 100$$

31. This balanced equation represents a chemical reaction:

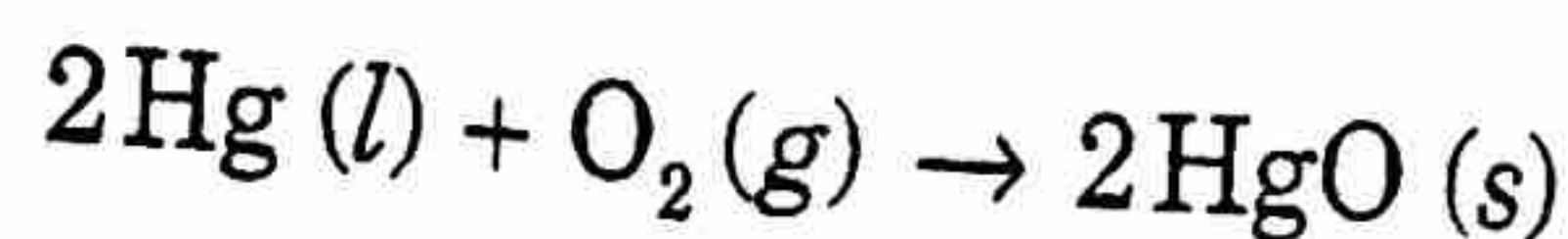


How many moles of KCl are produced when 4.25 moles of KClO_3 decompose?

- A 1.06 moles
- B 2.13 moles
- C 4.25 moles**
- D 8.50 moles

$$\frac{4.25 \text{ mol KClO}_3}{2 \text{ mol KClO}_3} \times 2 \text{ mol KCl} = 4.25 \text{ mol KCl}$$

32. Considering this balanced chemical equation, how many grams of HgO will be produced when 44 g of Hg react with excess O_2 ?



- A 28 g
- B 44 g
- C 48 g**
- D 96 g

$$\frac{44 \text{ g Hg}}{200.59 \text{ g Hg}} \times \frac{1 \text{ mol Hg}}{2 \text{ mol Hg}} \times \frac{2 \text{ mol HgO}}{1 \text{ mol Hg}} \times 216.59 \text{ g HgO} = 48 \text{ g HgO}$$

33. Which electron transition in the hydrogen atom will result in the emission of red light?

- ~~A $n = 2$ to $n = 3$~~
- ~~B $n = 2$ to $n = 4$~~
- C $n = 3$ to $n = 2$**
- D $n = 4$ to $n = 2$

← higher → lower

34. What can be said of a closed system when an exothermic reaction proceeds in an aqueous solution?

- ~~A There is a net energy loss.~~
- ~~B There is a net energy gain.~~
- C Heat is transferred from the water to the reactants.
- D Heat is transferred from the reactants to the water.**

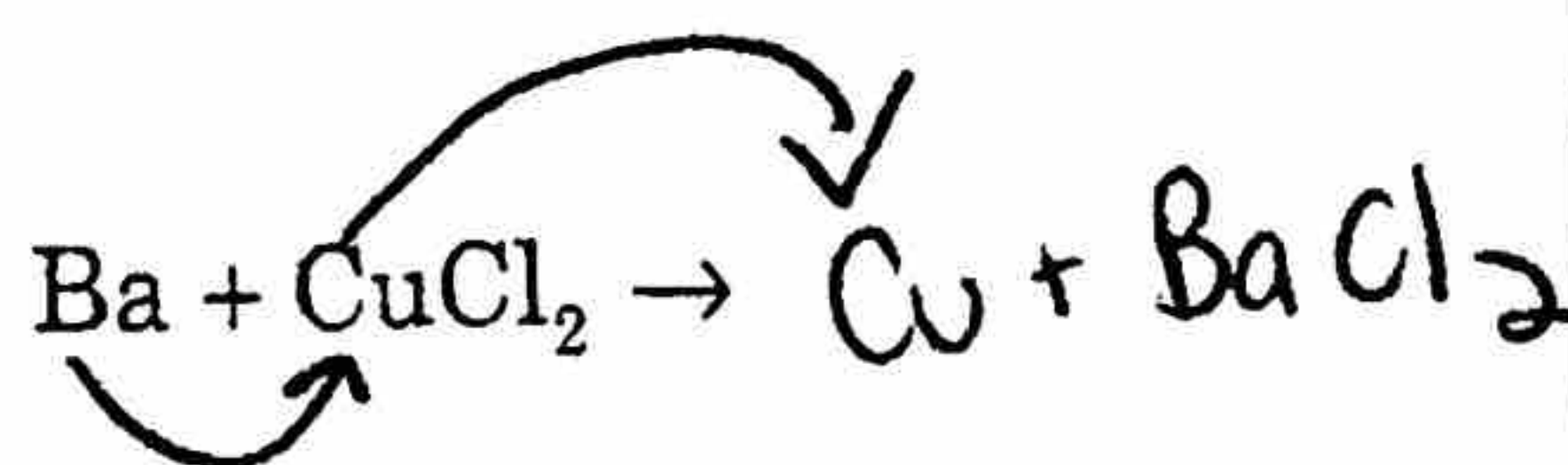
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35. In which group are the particles arranged in order of decreasing mass?

- A alpha, beta, neutron
 B alpha, neutron, beta
 C neutron, beta, alpha
 D neutron, alpha, beta

high → low

36. Consider this incomplete chemical equation:



Single replacement

What are the products of this equation?

- A BaCl_2 and CuCl_2
 B BaCuCl_2 and Ba
 C BaCl_2 and Cu
 D BaCu and Cl_2

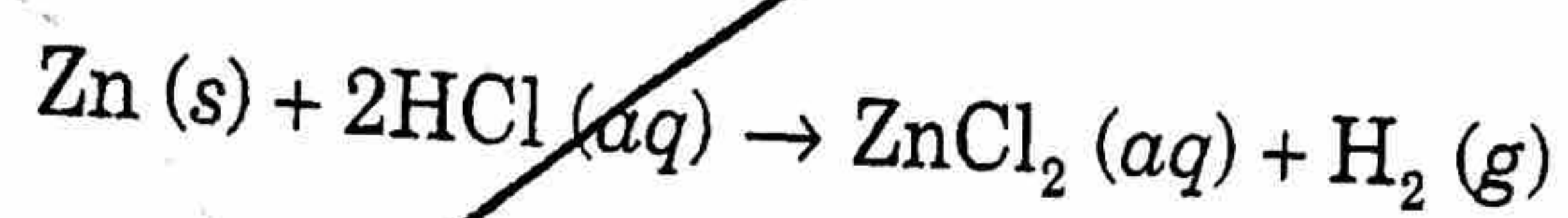
37. What is the **best** reason for using iron filings instead of an iron nail in a chemical reaction?

- A to decrease the amount of catalyst during the reaction
 B to increase the molecular structure during the reaction
 C to decrease the rate of reaction
 D to increase the surface area of the reaction

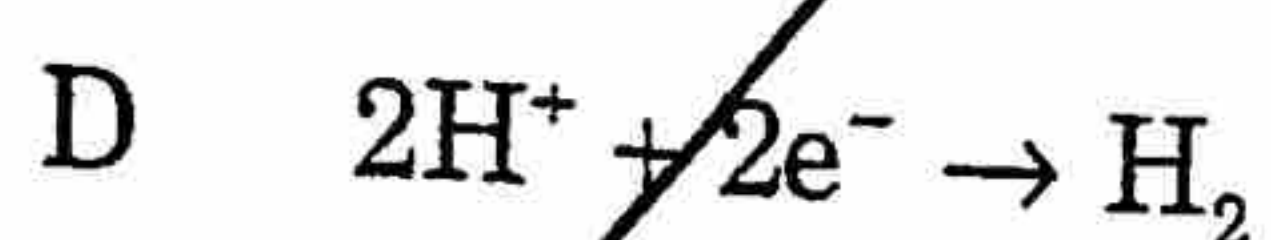
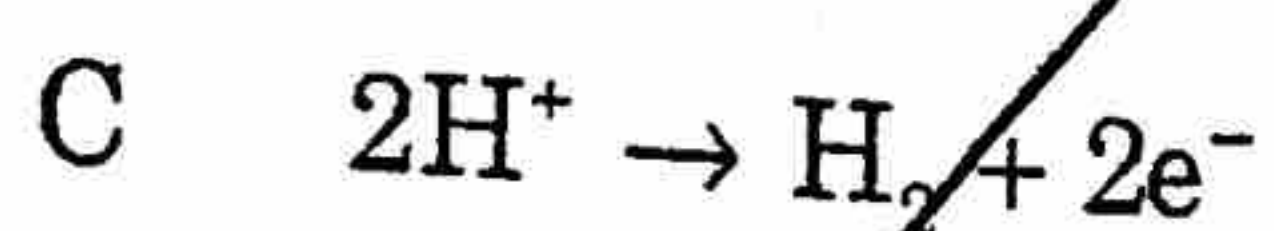
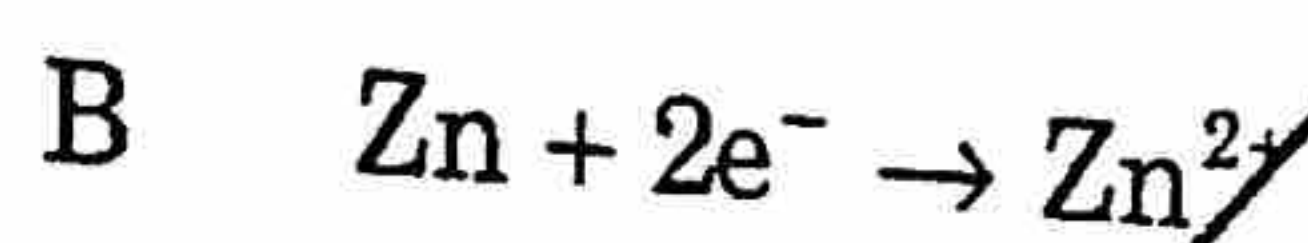
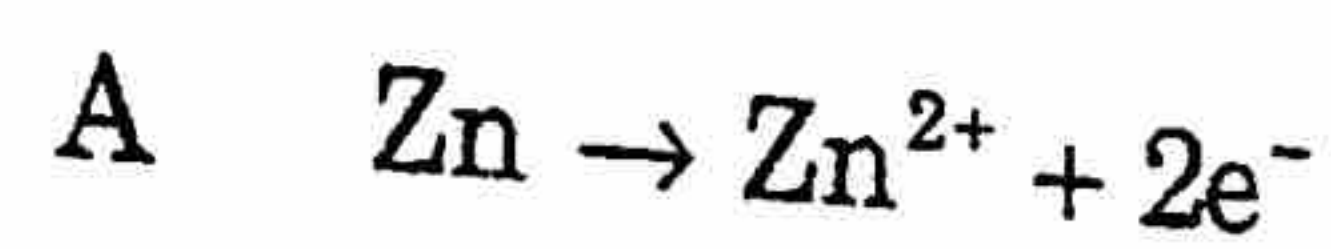
38. Which is a characteristic of a strong acid?

- A It has a pH greater than 7. base
 B It completely ionizes in solution.
 C It contains many hydroxide ions. base
 D It reacts only with a strong base.

39. Consider this balanced chemical equation:

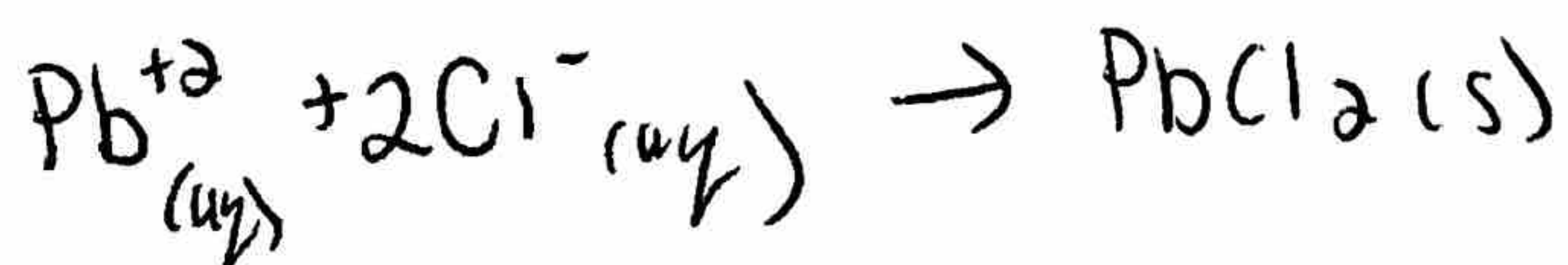
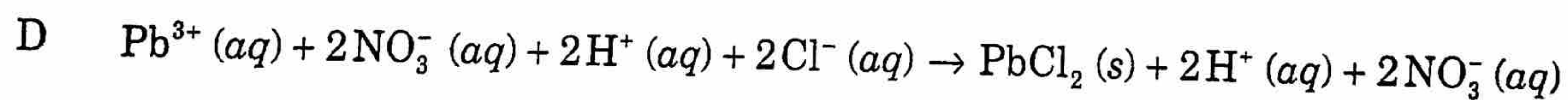
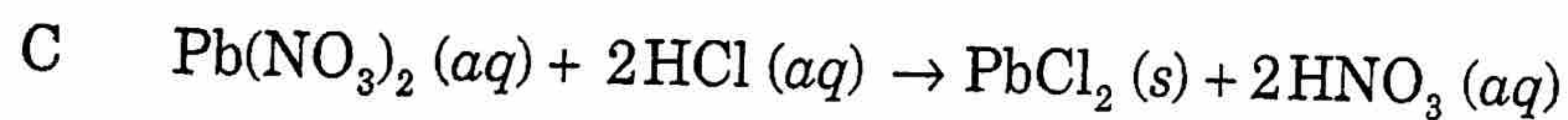
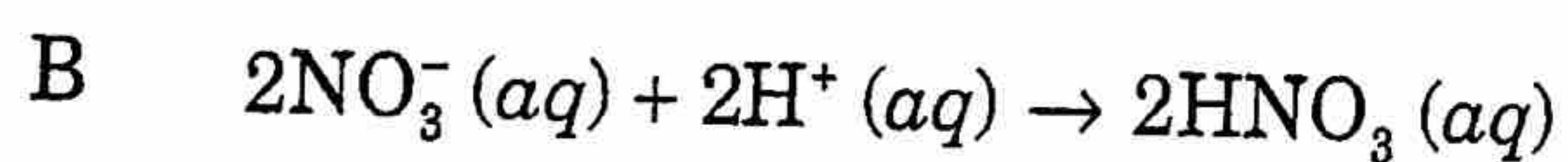
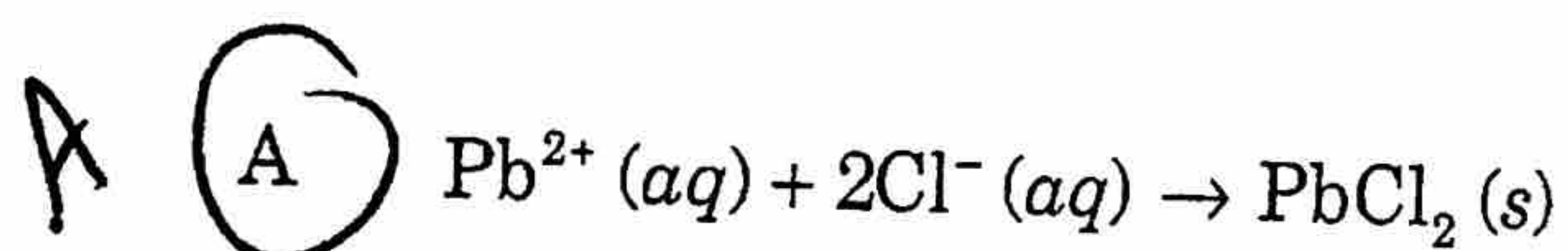


Which is the oxidation half-reaction?



Don't worry
about this 😊

40. What is the net ionic equation for the reaction between $\text{Pb}(\text{NO}_3)_2$ and HCl ?



41. When combined, two gases have a pressure of 4.0 atm. If one gas has a pressure of 1.5 atm, what is the pressure of the second gas?

A 1.5 atm

B 2.0 atm

C 2.5 atm

D 5.5 atm

$$P_{\text{total}} = P_1 + P_2$$

$$4.0 \text{ atm} = 1.5 \text{ atm} + x$$

$$2.5 \text{ atm}$$

42. What compound has the chemical formula MgI_2 ?

A di-iodide magnesium

B iodide(II) magnesium

C magnesium iodide

D magnesium(I) iodine(II)

43. Which elements have the same number of neutrons?

~~A~~ $^{10}_5\text{B}$ and $^{12}_6\text{C}$

B $^{55}_{25}\text{Mn}$ and $^{56}_{26}\text{Fe}$ each have 30

C $^{108}_{47}\text{Ag}$ and $^{112}_{48}\text{Cd}$

D $^{197}_{79}\text{Au}$ and $^{201}_{80}\text{Hg}$

44. This chart represents the melting point of several substances.

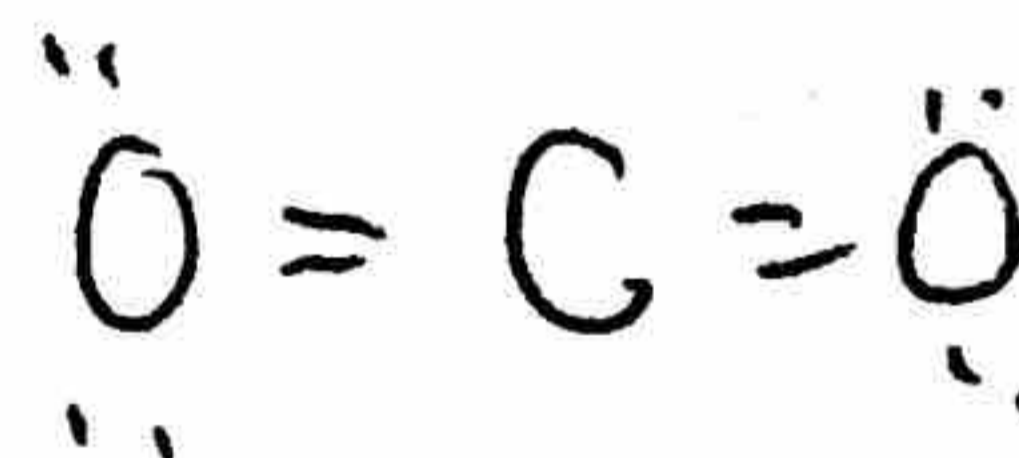
Substance	Melting Point ($^{\circ}\text{C}$)
Cl_2	-101.5
Na	97.72
NaCl	801

What *best* explains the high melting point of the salt?

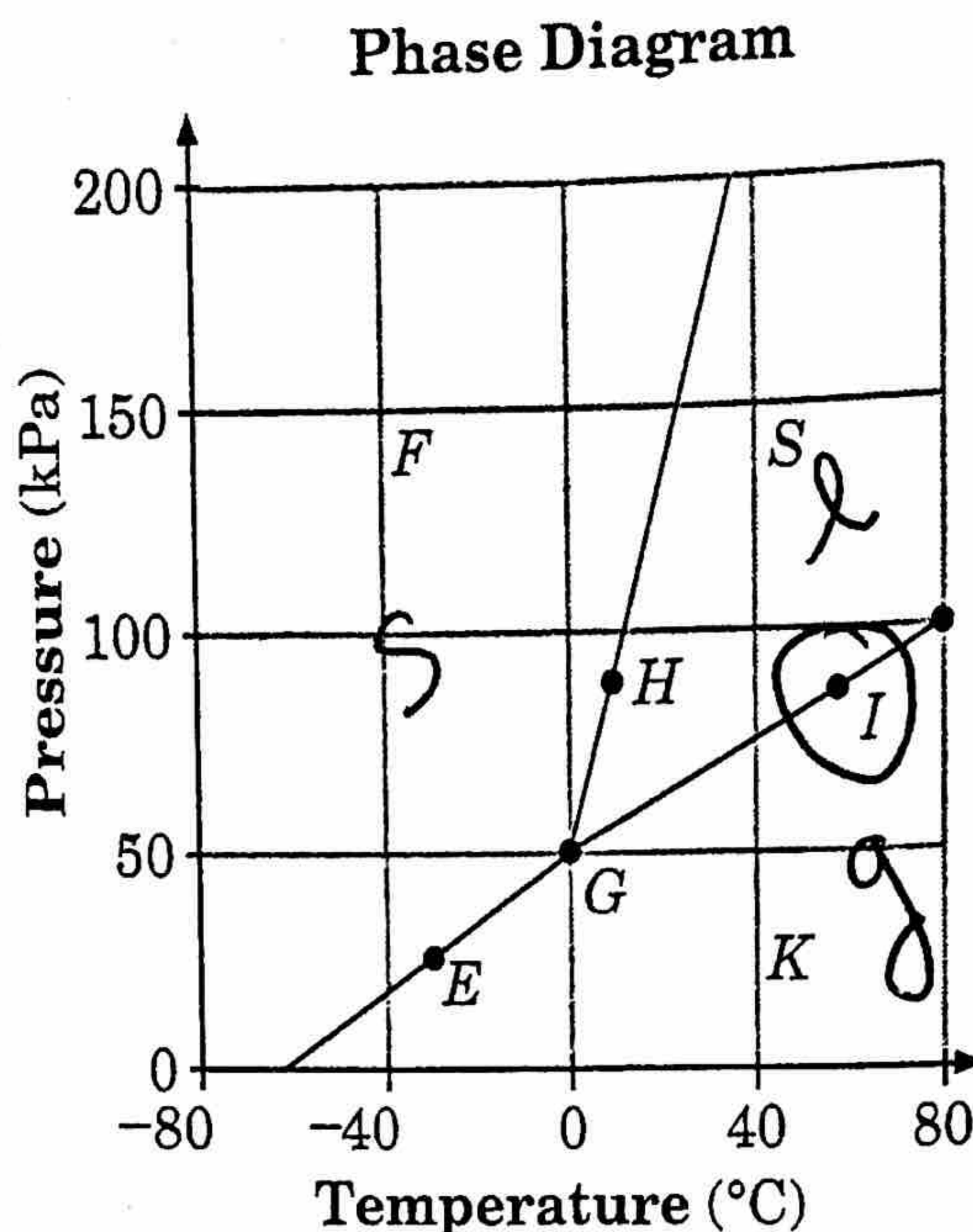
- A the strong electrostatic attraction between Na^0 and Cl^0
- B the weak electrostatic attraction between Na^0 and Cl^0
- C the weak electrostatic attraction between Na^+ and Cl^-
- D the strong electrostatic attraction between Na^+ and Cl^-

45. Based on the VSEPR theory, what is the molecular geometry of CO_2 ?

- A linear
- B tetrahedral
- C trigonal planar
- D trigonal pyramidal



46. This graph represents a phase diagram for a substance.



C What is the state of the substance at point I?

- A gas
- B liquid
- C liquid and gas
- D solid and liquid

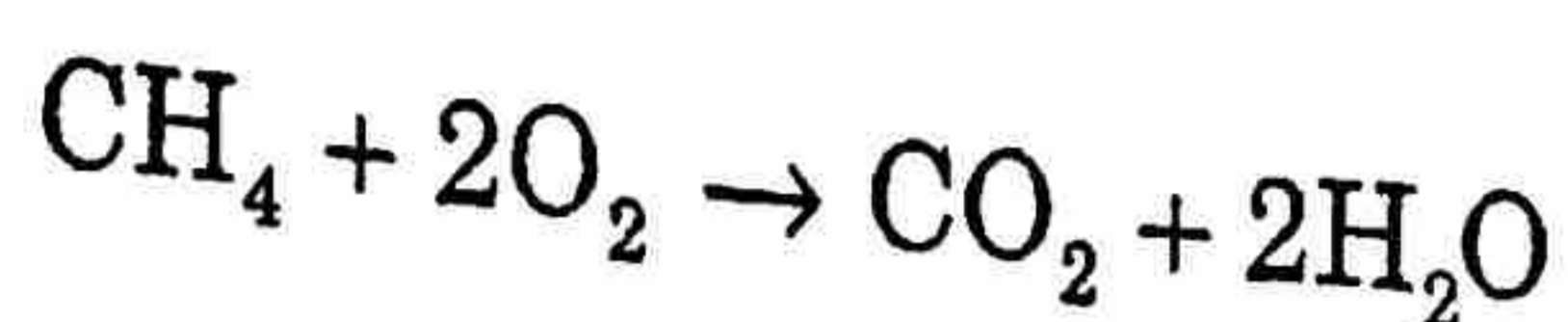
47. Which one of these compounds is soluble in water? *Solubility rules*

- A aluminum sulfide
- B calcium carbonate
- C iron(III) hydroxide
- D potassium sulfate

48. In which block does an element with the electron configuration $[Xe] 6s^2 4f^{14} 5d^{10} 6p^1$ belong?

- A s block
- B p block
- C d block
- D f block

49. Which statement is true for the reaction represented by this equation?



- A 1 gram of CH_4 is required to react with 2 grams of O_2 .
- B 1 gram of CH_4 is required to react with 4 grams of O_2 .
- C** 1 mole of CH_4 is required to react with 2 moles of O_2 . *Coefficients*
- D 1 mole of CH_4 is required to react with 4 moles of O_2 .

50. What is the percent by mass of N in $\text{Ca}(\text{CN})_2$?

- A 15.21%
- B 21.19%
- C** 30.42%
- D 42.39%

$$\frac{\text{N}_2}{\text{Ca}(\text{CN})_2} \times 100$$

$$\frac{28.02}{92.12} \times 100 = 30.42$$

51. Which orbital notation shows the lowest energy arrangement of valence electrons for $1s^2 2s^2 2p^3$?

- ~~A~~ $2s \uparrow\downarrow$
- B $2s \uparrow\downarrow \quad 2p \uparrow\downarrow \quad \uparrow \quad _$
- ~~D~~ C $2s \uparrow\downarrow \quad 2p \uparrow \quad \downarrow \quad \uparrow$
- D** $2s \uparrow\downarrow \quad 2p \uparrow \quad \uparrow \quad \uparrow$

52. What is the molarity of 28.9 g of CaCl_2 dissolved in water to make 0.78 L of solution?

- A** 0.33 M
- B 0.69 M
- C 1.5 M
- D 3.0 M

$$M = \frac{\text{mol}}{\text{L}} = \frac{.26}{.78 \text{ L}}$$

$$\frac{28.9 \text{ g CaCl}_2}{110.98 \text{ g}} \times \frac{1 \text{ mol}}{110.98 \text{ g}} = .2604 \text{ mol}$$

53. The half-life of phosphorus-32 is 14.3 days. How much of a sample of phosphorus-32 will remain after 57.2 days?

- A $\frac{1}{32}$
- B $\frac{1}{16}$
- C $\frac{1}{8}$
- D $\frac{1}{4}$

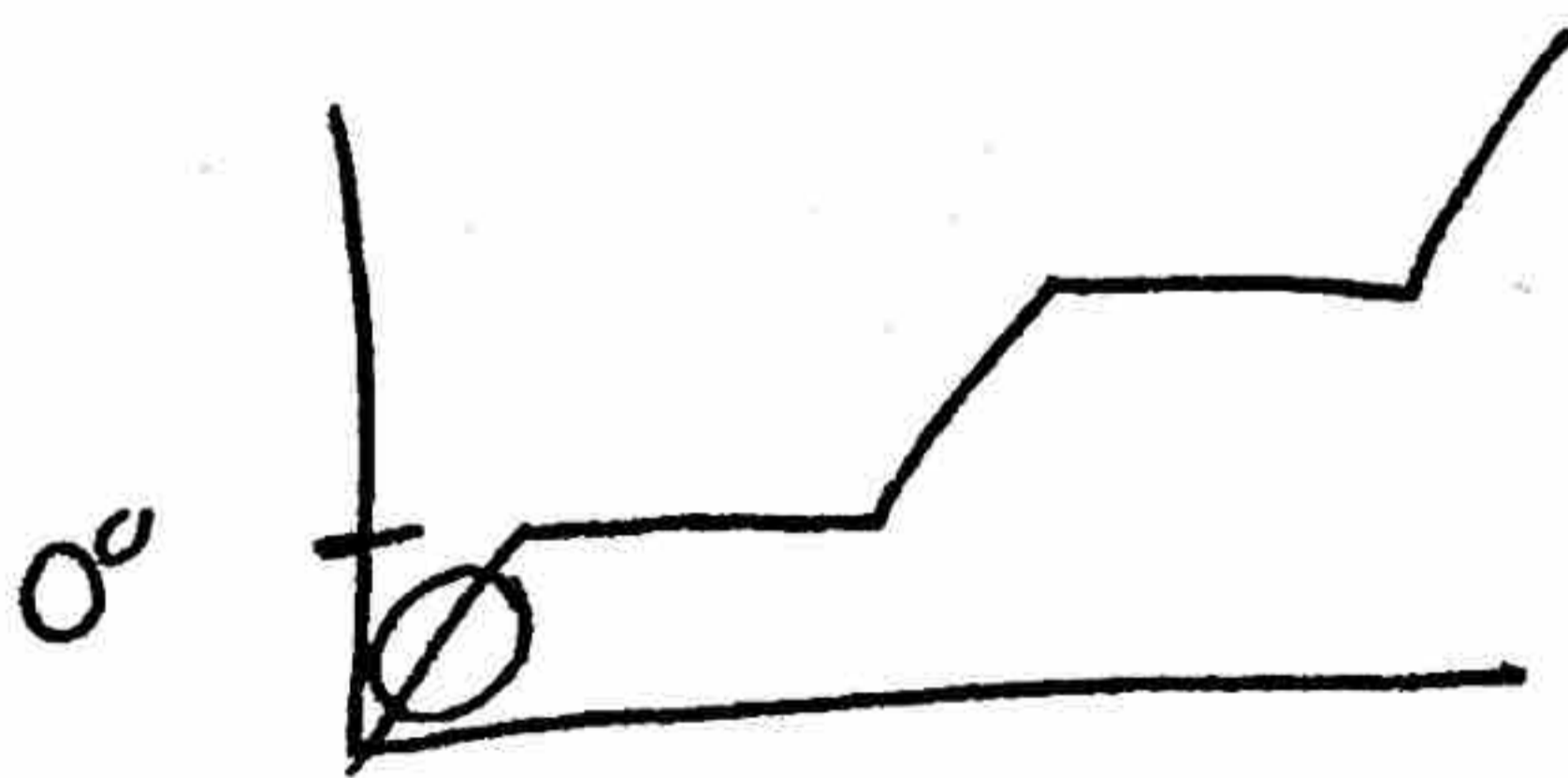
$$n = \frac{57.2}{14.3} = 4$$

$$1 \rightarrow \frac{1}{2} \rightarrow \frac{1}{4} \rightarrow$$

$$\frac{1}{8} \rightarrow \frac{1}{16}$$

54. To increase the temperature of 100.0 g of H₂O (s) from -50.0°C to -10.0°C, how much energy is required?

- A 1.67×10^4 J
- B 8.20×10^3 J
- C 8.08×10^3 J
- D 1.95×10^3 J



$$q = mc \Delta T$$

$$= (100)(2.05)(40^\circ\text{C})$$

$$q = 8200 \text{ J}$$

55. What is the [H⁺] of an HCl solution if the pH is measured to be 6?

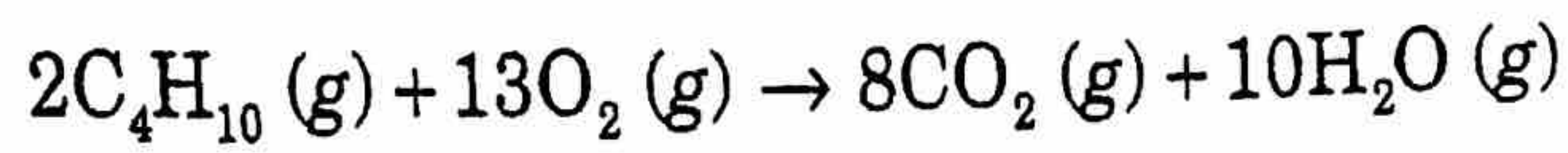
- A 1×10^{-7} M
- B 1×10^{-6} M
- C 6×10^{-6} M
- D 8×10^{-1} M

~~A~~

$$[\text{H}^+] = 10^{-\text{pH}}$$

$$10^{-6}$$

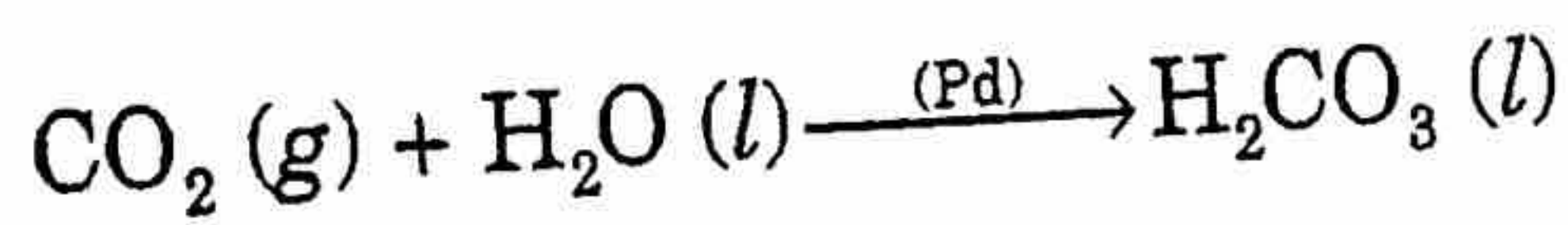
56. This balanced equation represents a chemical reaction.



What type of chemical reaction is represented by the equation?

- A A combustion
- B B decomposition
- C C double replacement
- D D single replacement

57. This balanced equation represents a chemical reaction using palladium, Pd, as a catalyst.



Without palladium the reaction is slow and produces low concentrations of product. How does the palladium increase the speed of the reaction?

- A A The palladium reacts with the water.
- B B The palladium lowers the activation energy.
- C C The palladium purifies the carbon dioxide.
- D D The palladium increases the reaction temperature.

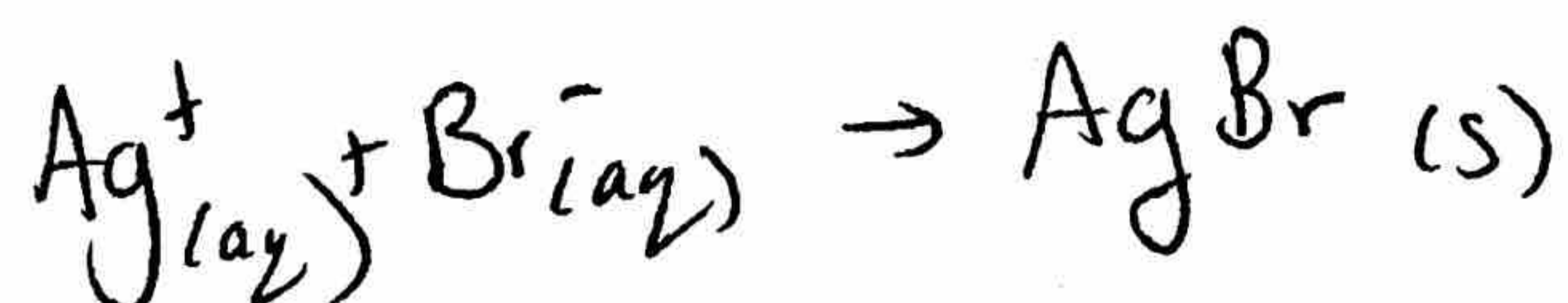
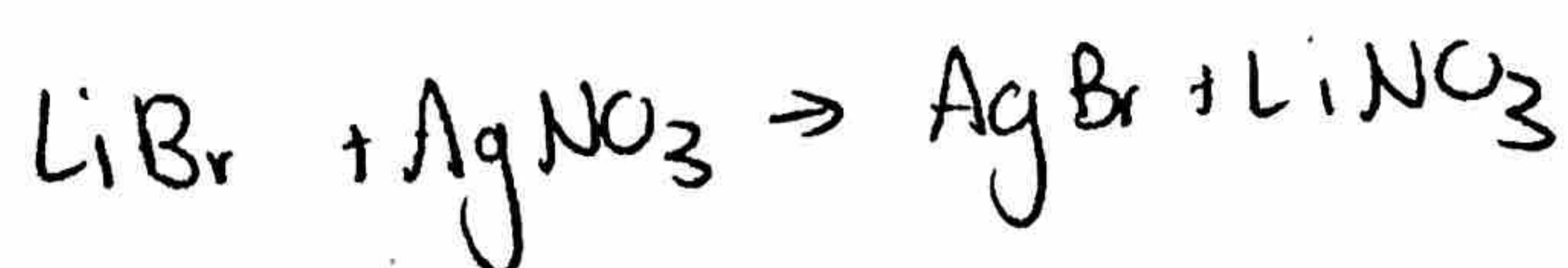
58. Which pair of substances will likely undergo a single replacement reaction?

- ~~A~~ Na and BaCl₂
- ~~B~~ Zn and BaCl₂
- ~~C~~ Ca and BaCl₂
- D K and BaCl₂

activity series
 * the element by itself needs to be higher on activity series

59. What is the net ionic equation for the reaction between aqueous solutions of LiBr and AgNO₃?

- A A $\text{Ag}^+(aq) + \text{Br}^-(aq) \rightarrow \text{AgBr}(s)$
- B $\text{Li}^+(aq) + \text{NO}_3^-(aq) \rightarrow \text{LiNO}_3(s)$
- C $\text{Li}^+(aq) + \text{Br}^-(aq) \rightarrow \text{LiBr}(s)$
- D $\text{Ag}^+(aq) + \text{NO}_3^-(aq) \rightarrow \text{AgNO}_3(s)$



60. A scientist hypothesizes that a colorless gas produced during a chemical reaction is carbon dioxide. Which observation would confirm this hypothesis?

- A The gas will react violently with water.
- B A glowing splint placed in the gas will burn brighter.
- D C Burning the gas in the presence of oxygen will produce water.
- D Bubbling the gas through lime water will make the lime water cloudy.



End of Chemistry Test