

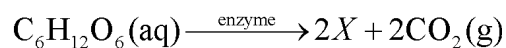
- Which molecular formula is correctly paired with its corresponding empirical formula?  
A)  $\text{CO}_2$  and  $\text{CO}$       B)  $\text{C}_2\text{H}_2$  and  $\text{CH}_2$   
C)  $\text{C}_6\text{H}_6$  and  $\text{C}_2\text{H}_2$       **D)  $\text{P}_4\text{O}_{10}$  and  $\text{P}_2\text{O}_5$**
- What is the empirical formula for  $\text{C}_3\text{H}_6$ ?  
A)  $\text{CH}$     **B)  $\text{CH}_2$**     C)  $\text{CH}_3$     D)  $\text{CH}_6$
- What is the empirical formula for the compound  $\text{C}_6\text{H}_{12}\text{O}_6$ ?  
**A)  $\text{CH}_2\text{O}$**       B)  $\text{C}_2\text{H}_4\text{O}_2$   
C)  $\text{C}_3\text{H}_6\text{O}_3$       D)  $\text{C}_6\text{H}_{12}\text{O}_6$
- The empirical formula of a compound is  $\text{CH}_2$ . The molecular formula of this compound could be  
A)  $\text{CH}_4$     B)  $\text{C}_2\text{H}_2$     **C)  $\text{C}_2\text{H}_4$**     D)  $\text{C}_2\text{H}_6$
- The empirical formula of a compound is  $\text{CH}_2$ . The molecular formula of this compound could be  
A)  $\text{CH}_4$     B)  $\text{C}_2\text{H}_2$     **C)  $\text{C}_2\text{H}_4$**     D)  $\text{C}_3\text{H}_3$
- The formula  $\text{H}_2\text{O}_2$  is an example of  
**A) a molecular formula**  
B) an empirical formula  
C) an ionic formula  
D) an organic formula
- What is the gram formula mass of  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ ?  
A) 106 g    B) 142 g    C) 266 g    **D) 286 g**
- The molar mass of  $\text{Ba}(\text{OH})_2$  is  
A) 154.3 g      B) 155.3 g  
**C) 171.3 g**      D) 308.6 g
- What is the gram-formula mass of  $\text{Ca}_3(\text{PO}_4)_2$ ?  
A) 248 g/mol      B) 263 g/mol  
C) 279 g/mol      **D) 310. g/mol**
- What is the gram formula mass of  $\text{Li}_2\text{SO}_4$ ?  
A) 54 g    B) 55 g    **C) 110 g**    D) 206 g
- Which substance has the greatest molecular mass?  
A)  $\text{H}_2\text{O}_2$     B)  $\text{NO}$     C)  $\text{CF}_4$     **D)  $\text{I}_2$**
- Which represents the greatest mass of chlorine?  
**A) 1 mole of chlorine**  
B) 1 atom of chlorine  
C) 1 gram of chlorine  
D) 1 molecule of chlorine
- What is the total number of atoms of oxygen in the formula  $\text{Al}(\text{ClO}_3)_3 \cdot 6\text{H}_2\text{O}$ ?  
A) 6    B) 9    C) 10    **D) 15**
- How many moles of water are contained in 0.250 mole of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ?  
**A) 1.25**    B) 4.50    C) 40.0    D) 62.5
- What is the total mass of oxygen in 1.00 mole of  $\text{Al}_2(\text{CrO}_4)_3$ ?  
**A) 192 g**      B) 112 g  
C) 64.0 g      D) 48.0 g
- The total number of moles represented by 20 grams of  $\text{CaCO}_3$  is  
A) 1    B) 2    C) 0.1    **D) 0.2**
- Which sample contains a mole of atoms?  
**A) 23 g Na**      B) 24 g C  
C) 42 g Kr      D) 78 g K
- What is the total mass in grams of 0.75 mole of  $\text{SO}_2$ ?  
A) 16 g    B) 24 g    C) 32 g    **D) 48 g**
- What is the mass in grams of 1.00 mole of  $\text{O}_2$  gas?  
A) 11.2    B) 16.0    C) 22.4    **D) 32.0**
- If the empirical formula for an organic compound is  $\text{CH}_2\text{O}$ , then the molecular mass of the compound could be  
A) 135    **B) 60**    C) 45    D) 15
- A compound has an empirical formula of  $\text{CH}_2$  and a molecular mass of 56. What is its molecular formula?  
A)  $\text{CH}_2$     B)  $\text{C}_2\text{H}_4$     C)  $\text{C}_3\text{H}_6$     **D)  $\text{C}_4\text{H}_8$**
- Which of the following gases has the greatest density at STP?  
A)  $\text{SO}_2$     B)  $\text{CO}_2$     **C)  $\text{Cl}_2$**     D)  $\text{N}_2$
- A sample of an unknown gas at STP has a density of 1.25 grams per liter. What is the gram molecular mass of this gas?  
**A) 28.0 g**      B) 44.0 g  
C) 64.0 g      D) 80.0 g
- A compound consists of 25.9% nitrogen and 74.1% oxygen by mass. What is the empirical formula of the compound?  
A)  $\text{NO}$     B)  $\text{NO}_2$     C)  $\text{N}_2\text{O}$     **D)  $\text{N}_2\text{O}_5$**

## Regents review Stoichiometry

25. What is the empirical formula of a compound that contains 30.4% nitrogen and 69.6% oxygen by mass?  
 A) NO    **B) NO<sub>2</sub>**    C) N<sub>2</sub>O<sub>3</sub>    D) N<sub>2</sub>O<sub>5</sub>
26. A compound consists of 40.% sulfur and 60.% oxygen by mass. What is the empirical formula of this compound?  
 A) SO    B) SO<sub>2</sub>    **C) SO<sub>3</sub>**    D) SO<sub>4</sub>
27. What is the percent by mass of carbon in CO<sub>2</sub>?  
 A) 12    **B) 27**    C) 44    D) 73
28. What is the percent composition by mass of nitrogen in NH<sub>4</sub>NO<sub>3</sub> (gram-formula mass = 80.0 grams/mole)?  
 A) 17.5%    **B) 35.0%**  
 C) 52.5%    D) 60.0%
29. Given the balanced equations representing two chemical reactions:
- $$\text{Cl}_2 + 2\text{NaBr} \rightarrow 2\text{NaCl} + \text{Br}_2$$
- $$2\text{NaCl} \rightarrow 2\text{Na} + \text{Cl}_2$$
- Which type of chemical reactions are represented by these equations?  
**A) single replacement and decomposition**  
 B) single replacement and double replacement  
 C) synthesis and decomposition  
 D) synthesis and double replacement
30. Which balanced equation represents a chemical change?  
 A) H<sub>2</sub>O(l) + energy → H<sub>2</sub>O(g)  
**B) 2H<sub>2</sub>O(l) + energy → 2H<sub>2</sub>(g) + O<sub>2</sub>(g)**  
 C) H<sub>2</sub>O(l) → H<sub>2</sub>O(s) + energy  
 D) H<sub>2</sub>O(g) → H<sub>2</sub>O(l) + energy
31.  $2 \text{CO}(g) + \text{O}_2(g) \leftrightarrow 2 \text{CO}_2(g)$
- What type of reaction is shown above?  
**A) synthesis**    B) decomposition  
 C) single replacement    D) double replacement
32.  $\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow 2 \text{NaNO}_3(\text{aq}) + \text{BaSO}_4(\text{s})$
- What type of reaction is shown above?  
 A) synthesis  
 B) decomposition  
 C) single replacement  
**D) double replacement**
33. Given the reaction at 101.3 kilopascals and 298 K:  
 hydrogen gas + iodine gas → hydrogen iodide gas
- This reaction is classified as  
**A) endothermic, because heat is absorbed**  
 B) endothermic, because heat is released  
 C) exothermic, because heat is absorbed  
 D) exothermic, because heat is released
34. Which equation shows a conservation of mass?  
 A) Na + Cl<sub>2</sub> → NaCl    B) Al + Br<sub>2</sub> → AlBr<sub>3</sub>  
 C) H<sub>2</sub>O → H<sub>2</sub> + O<sub>2</sub>    **D) PCl<sub>5</sub> → PCl<sub>3</sub> + Cl<sub>2</sub>**
35. Which equation shows conservation of atoms?  
 A) H<sub>2</sub> + O<sub>2</sub> → H<sub>2</sub>O  
 B) H<sub>2</sub> + O<sub>2</sub> → 2H<sub>2</sub>O  
**C) 2H<sub>2</sub> + O<sub>2</sub> → 2H<sub>2</sub>O**  
 D) 2H<sub>2</sub> + 2O<sub>2</sub> → 2H<sub>2</sub>O
36. Given the balanced equation representing a reaction:  
 $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\ell) + 55.8 \text{ kJ}$
- In this reaction there is conservation of  
 A) mass, only  
 B) mass and charge, only  
 C) mass and energy, only  
**D) mass, charge, and energy**
37. Base your answer to the following question on Given the unbalanced equation:
- $$\_\_ \text{Al} + \_\_ \text{CuSO}_4 \rightarrow \_\_ \text{Al}_2(\text{SO}_4)_3 + \_\_ \text{Cu}$$
- When the equation is balanced using the *smallest* whole-number coefficients, what is the coefficient of Al?  
 A) 1    **B) 2**    C) 3    D) 4

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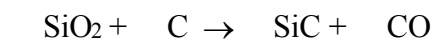
38. Given the balanced equation with an unknown compound represented by  $X$ :



Which compound is represented by  $X$ ?

- A)  $\text{CH}_3\text{OH}(\text{aq})$       B)  $\text{CH}_2(\text{OH})_4(\text{aq})$   
**C)  $\text{CH}_3\text{CH}_2\text{OH}(\text{aq})$**       D)  $\text{CH}_2\text{OHCH}_2\text{OH}(\text{aq})$

39. When the equation



is correctly balanced using whole-number coefficients, the sum of all the coefficients is

- A) 6      **B) 7**      C) 8      D) 9

40. Which chemical equation is correctly balanced?

- A)  $\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{g})$   
 B)  $\text{N}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{NH}_3(\text{g})$   
 C)  $2\text{NaCl}(\text{s}) \rightarrow \text{Na}(\text{s}) + \text{Cl}_2(\text{g})$   
**D)  $2\text{KCl}(\text{s}) \rightarrow 2\text{K}(\text{s}) + \text{Cl}_2(\text{g})$**

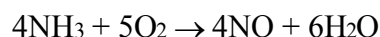
41. Given the incomplete equation:



Which compound is represented by  $X$ ?

- A)  $\text{FeO}$       **B)  $\text{Fe}_2\text{O}_3$**   
 C)  $\text{Fe}_3\text{O}_2$       D)  $\text{Fe}_3\text{O}_4$

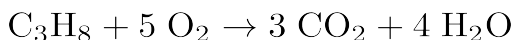
42. Given the balanced equation representing a reaction:



What is the *minimum* number of moles of  $\text{O}_2$  that are needed to completely react with 16 moles of  $\text{NH}_3$ ?

- A) 16 mol      **B) 20. mol**  
 C) 64 mol      D) 80. mol

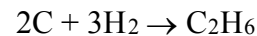
43. Given the balanced equation representing the reaction between propane and oxygen:



According to this equation, which ratio of oxygen to propane is correct?

- A)  $\frac{5 \text{ grams O}_2}{1 \text{ gram C}_3\text{H}_8}$       **B)  $\frac{5 \text{ moles O}_2}{1 \text{ mole C}_3\text{H}_8}$**   
 C)  $\frac{10 \text{ grams O}_2}{11 \text{ grams C}_3\text{H}_8}$       D)  $\frac{10 \text{ moles O}_2}{11 \text{ moles C}_3\text{H}_8}$

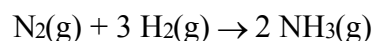
44. Base your answer to the following question on Given the balanced equation:



What is the total number of moles of C that must completely react to produce 2.0 moles of  $\text{C}_2\text{H}_6$ ?

- A) 1.0 mol      B) 2.0 mol  
 C) 3.0 mol      **D) 4.0 mol**

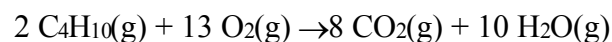
45. Given the reaction:



What is the total number of moles of  $\text{NH}_3(\text{g})$  produced when 10. moles of  $\text{H}_2(\text{g})$  reacts completely with  $\text{N}_2(\text{g})$ ?

- A) 6.7**      B) 2.0      C) 3.0      D) 15

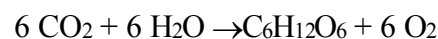
46. Base your answer to the following question on Given the balanced equation:



What is the total number of moles of  $\text{O}_2(\text{g})$  that must react completely with 5.00 moles of  $\text{C}_4\text{H}_{10}(\text{g})$ ?

- A) 10.0      B) 20.0      C) 26.5      **D) 32.5**

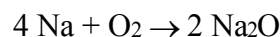
47. Base your answer to the following question on Given the reaction:



What is the total number of moles of water needed to make 2.5 moles of  $\text{C}_6\text{H}_{12}\text{O}_6$  ?

- A) 2.5      B) 6.0      C) 12      **D) 15**

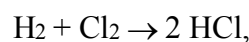
48. Given the reaction:



How many grams of oxygen are completely consumed in the production of 1.00 mole of  $\text{Na}_2\text{O}$ ?

- A) 16.0**      B) 32.0      C) 62.0      D) 124

49. According to the reaction



the production of 2.0 moles of  $\text{HCl}$  would require 70. grams of  $\text{Cl}_2$  and

- A) 1.0 g of  $\text{H}_2$       **B) 2.0 g of  $\text{H}_2$**   
 C) 3.0 g of  $\text{H}_2$       D) 4.0 g of  $\text{H}_2$

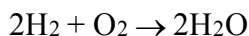
50. Given the reaction:



What is the total mass of H<sub>2</sub>O produced when 32 grams of Cu is completely consumed?

- A) 9.0 g    **B) 18 g**    C) 36 g    D) 72 g

51. Base your answer to the following question on Given the balanced equation representing a reaction:



What is the total mass of water formed when 8 grams of hydrogen reacts completely with 64 grams of oxygen?

- A) 18 g    B) 36 g    C) 56 g    **D) 72 g**

52. What is the approximate total number of atoms in 1.0 mole of lithium?

- A)  $1.0 \times 10^{23}$                       **B)  $6.0 \times 10^{23}$**   
 C) 3.0                                      D) 6.9

53. How many molecules are in 0.25 mole of O<sub>2</sub>?

- A)  $12 \times 10^{23}$                       B)  $6.0 \times 10^{23}$   
 C)  $3.0 \times 10^{23}$                       **D)  $1.5 \times 10^{23}$**

54. What is the total volume occupied by 132 grams of CO<sub>2</sub> (g) at STP?

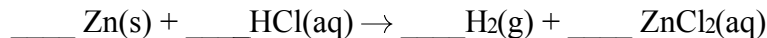
- A) 22.4 L                                  B) 33.6 L  
 C) 44.8 L                                  **D) 67.2 L**

55. At STP, 1 mole of He(g) contains the same number of atoms as

- A) 22.4 L of H<sub>2</sub>(g)                  B) 44.8 L of H<sub>2</sub>(g)  
**C) 22.4 L of Ar(g)**                  D) 44.8 L of Ar(g)

56. Base your answer to the following question on the information below.

A 1.0-gram strip of zinc is reacted with hydrochloric acid in a test tube. The unbalanced equation below represents the reaction.



Balance the equation for the reaction of zinc and hydrochloric acid, using the smallest whole-number coefficients.



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Base your answers to questions **57** and **58** on the information below.

Vitamin C, also known as ascorbic acid, is water soluble and cannot be produced by the human body. Each day, a person's diet should include a source of vitamin C, such as orange juice. Ascorbic acid has a molecular formula of  $C_6H_8O_6$  and a gram-formula mass of 176 grams per mole.

57. Show a numerical setup for calculating the percent composition by mass of oxygen in ascorbic acid.

58. Write the empirical formula for ascorbic acid.

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Base your answers to questions **59** and **60** on the information below.

A tablet of one antacid contains citric acid,  $H_3C_6H_5O_7$ , and sodium hydrogen carbonate,  $NaHCO_3$ . When the tablet dissolves in water, bubbles of  $CO_2$  are produced. This reaction is represented by the incomplete equation below.



59. Determine the total number of moles of sodium hydrogen carbonate that will completely react with 0.010 mole of citric acid.

60. write the formula of the missing product.

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61. Base your answer to the following question on the information below.

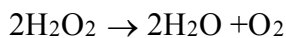
In an experiment, 2.54 grams of copper completely reacts with sulfur, producing 3.18 grams of copper(I) sulfide.

Write the chemical formula of the compound produced.

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Base your answers to questions **62** through **64** on the information below.

Hydrogen peroxide,  $H_2O_2$ , is a water-soluble compound. The concentration of an aqueous hydrogen peroxide solution that is 3% by mass  $H_2O_2$  is used as an antiseptic. When the solution is poured on a small cut in the skin,  $H_2O_2$  reacts according to the balanced equation below.

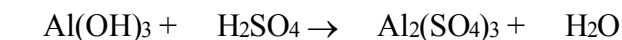


62. Determine the gram-formula mass of  $H_2O_2$ .

63. Calculate the total mass of  $H_2O_2$  in 20.0 grams of an aqueous  $H_2O_2$  solution that is used as an antiseptic. Your response must include *both* a numerical setup and the calculated result.

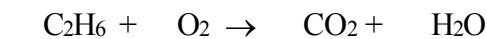
64. Identify the type of chemical reaction represented by the balanced equation.

65. Given the unbalanced equation:



Balance the equation using smallest whole number coefficients.

66. Given the unbalanced equation:



Balance the equation using smallest whole number coefficients.

67. In a laboratory experiment, a student determined the mass of the product, LiCl(s), to be 0.333 grams.

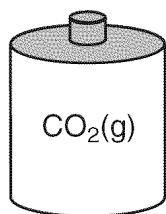
*a* Calculate the gram formula mass of LiCl(s). Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer in proper significant figures and include an appropriate unit.]

*b* Calculate the number of moles of LiCl(s) produced. [Show all work. Indicate the correct answer in proper significant figures.]

68. Base your answer to the following question on the information and diagrams below.

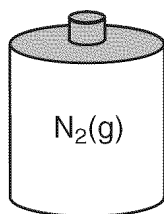
Cylinder A contains 22.0 grams of CO<sub>2</sub>(g) and cylinder B contains N<sub>2</sub>(g). The volumes, pressures, and temperatures of the two gases are indicated under each cylinder.

**Cylinder A**



V = 12.3 L  
P = 1.0 atm  
T = 300. K

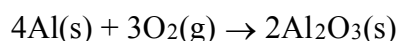
**Cylinder B**



V = 12.3 L  
P = 1.0 atm  
T = 300. K

Explain why the number of molecules of N<sub>2</sub>(g) in cylinder B is the same as the number of molecules of CO<sub>2</sub>(g) in cylinder A.

69. Given the balanced equation:



What is the total number of moles of O<sub>2</sub>(g) that must react completely with 8.0 moles of Al(s) in order to form Al<sub>2</sub>O<sub>3</sub>(s)?

70. Base your answer to the following question on the information below.

A scientist in a chemistry laboratory determined the molecular formulas for two compounds containing nitrogen and oxygen to be NO<sub>2</sub> and N<sub>2</sub>O<sub>5</sub>.

Write an IUPAC name for the compound N<sub>2</sub>O<sub>5</sub>.

# Answer Key

## Regents review Stoichiometry 2011-2012

- |                     |   |   |
|---------------------|---|---|
| 1. <u><b>D</b></u>  | 37. <u><b>B</b></u>   | 64. –decomposition<br>–redox  |
| 2. <u><b>B</b></u>  | 38. <u><b>C</b></u>   | 65. $\underline{2}$ Al(OH) <sub>3</sub> + $\underline{3}$ H <sub>2</sub><br>SO <sub>4</sub> → $\underline{1}$ Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub><br>+ $\underline{6}$ H <sub>2</sub> O |
| 3. <u><b>A</b></u>  | 39. <u><b>B</b></u>   | 66. $\underline{2}$ C <sub>2</sub> H <sub>6</sub> + $\underline{7}$ O <sub>2</sub><br>→ $\underline{4}$ CO <sub>2</sub> + $\underline{6}$ H <sub>2</sub><br>O                                       |
| 4. <u><b>C</b></u>  | 40. <u><b>D</b></u>   | 67. a) 6.9 + 35.5 = 42.4g<br>b) 0.333g × 1.00<br>mole/42.4g = 0.00785<br>mole   |
| 5. <u><b>C</b></u>  | 41. <u><b>B</b></u>   | 68. Equal volumes of two<br>gases at the same<br>temperature and<br>pressure contain equal<br>number of particles.  |
| 6. <u><b>A</b></u>  | 42. <u><b>B</b></u>   | 69. 6   |
| 7. <u><b>D</b></u>  | 43. <u><b>B</b></u>   | 70. Responses include,<br>but are not limited to,<br>these examples:<br>dinitrogen pentoxide<br>• nitrogen(V) oxide   |
| 8. <u><b>C</b></u>  | 44. <u><b>D</b></u>   |   |
| 9. <u><b>D</b></u>  | 45. <u><b>A</b></u>   |   |
| 10. <u><b>C</b></u> | 46. <u><b>D</b></u>   |   |
| 11. <u><b>D</b></u> | 47. <u><b>D</b></u>   |   |
| 12. <u><b>A</b></u> | 48. <u><b>A</b></u>   |   |
| 13. <u><b>D</b></u> | 49. <u><b>B</b></u>   |   |
| 14. <u><b>A</b></u> | 50. <u><b>B</b></u>   |   |
| 15. <u><b>A</b></u> | 51. <u><b>D</b></u>   |   |
| 16. <u><b>D</b></u> | 52. <u><b>B</b></u>   |   |
| 17. <u><b>A</b></u> | 53. <u><b>D</b></u>   |   |
| 18. <u><b>D</b></u> | 54. <u><b>D</b></u>   |   |
| 19. <u><b>D</b></u> | 55. <u><b>C</b></u>   |   |
| 20. <u><b>B</b></u> | 56. Answer: <u>    </u> Zn(s) +<br><u>  2  </u> HCl(aq) →<br><u>    </u> H <sub>2</sub> (g) + <u>    </u><br>ZnCl <sub>2</sub> (aq) |   |
| 21. <u><b>D</b></u> | 57. $\frac{6(16 \text{ g/mol})}{176 \text{ g/mol}} \times 100$<br><br>$\frac{(96)(100)}{176}$                                       |   |
| 22. <u><b>C</b></u> | 58. C <sub>3</sub> H <sub>4</sub> O <sub>3</sub>  |   |
| 23. <u><b>A</b></u> | 59. 0.030 mol. Significant<br>figures do <i>not</i> need to<br>be shown.  |   |
| 24. <u><b>D</b></u> | 60. H <sub>2</sub> O.   |   |
| 25. <u><b>B</b></u> | 61. Cu <sub>2</sub> S   |   |
| 26. <u><b>C</b></u> | 62. 34 g/mol.   |   |
| 27. <u><b>B</b></u> | 63. A correct numerical<br>setup is shown: 3 =<br>$\frac{x}{20.0g} \times 100$ <i>or</i><br>(20)(0.03)                              |   |
| 28. <u><b>B</b></u> |   |   |
| 29. <u><b>A</b></u> |   |   |
| 30. <u><b>B</b></u> |   |   |
| 31. <u><b>A</b></u> |   |   |
| 32. <u><b>D</b></u> |   |   |
| 33. <u><b>A</b></u> |   |   |
| 34. <u><b>D</b></u> |   |   |
| 35. <u><b>C</b></u> |   |   |
| 36. <u><b>D</b></u> |   |   |