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**CHEMISTRY
STANDARD LEVEL
PAPER 1**

Thursday 16 May 2013 (afternoon)

45 minutes

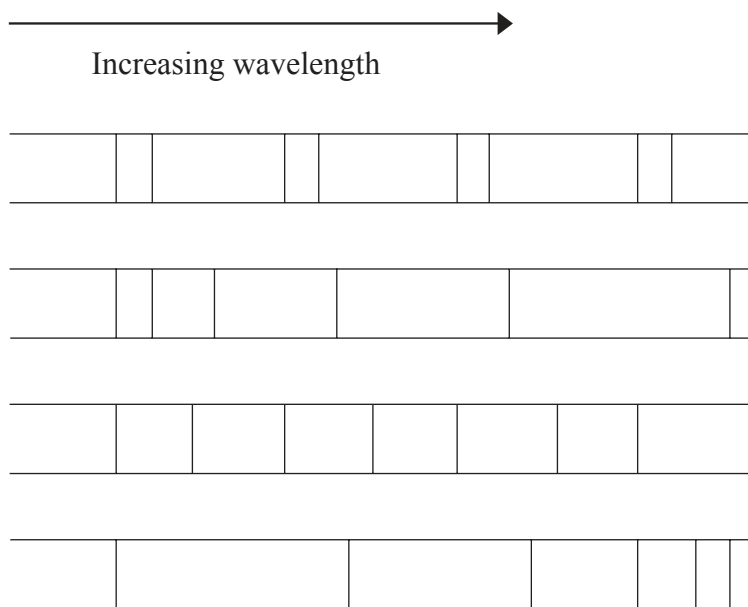
INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The periodic table is provided for reference on page 2 of this examination paper.
- The maximum mark for this examination paper is [30 marks].

1. Which statements are correct about Avogadro's constant?
- I. It is the number of ions in 12 g of sodium hydride, NaH.
 - II. It is the number of molecules in 22.4 dm³ of hydrogen gas at 0°C and 1 atm.
 - III. It is the number of atoms in 12 g of ¹²C.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
2. What is the molar mass, in g mol⁻¹, of a substance if 0.30 mol of the substance has a mass of 18 g?
- A. 5.4
 - B. 6.0
 - C. 30
 - D. 60
3. What is the whole number ratio of the coefficients of ammonia to oxygen when the following equation is balanced correctly?
- $$\underline{\hspace{1cm}} \text{NH}_3(\text{g}) + \underline{\hspace{1cm}} \text{O}_2(\text{g}) \rightarrow \underline{\hspace{1cm}} \text{NO}(\text{g}) + \underline{\hspace{1cm}} \text{H}_2\text{O}(\text{l})$$
- A. 1 : 2
 - B. 2 : 1
 - C. 4 : 5
 - D. 5 : 4

4. When 50 cm^3 of a hydrocarbon, C_xH_y , was burned in excess oxygen, 200 cm^3 of carbon dioxide and 250 cm^3 of steam were produced (all volumes were measured under the same conditions). What is the molecular formula of the hydrocarbon?
- A. C_2H_4
B. C_3H_8
C. C_4H_8
D. C_4H_{10}
5. What is the pressure, in Pa, in a 100 cm^3 container containing 1.8 g of steam at a temperature of 727°C ? ($R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)
- A. $\frac{1.8 \times 8.31 \times 727}{18 \times 100}$
B. $\frac{18 \times 100}{1.8 \times 8.31 \times 727}$
C. $\frac{1.8 \times 8.31 \times 1000}{18 \times 10^{-4}}$
D. $\frac{1.8 \times 8.31}{1.8 \times 10^{-4} \times 1000}$
6. Which statements about the isotopes of an element are correct?
- I. They have the same chemical properties.
II. They have different physical properties.
III. They have the same number of protons and electrons.
- A. I and II only
B. I and III only
C. II and III only
D. I, II and III

7. Which diagram shows a pattern similar to the emission spectrum of hydrogen?



8. Which statement concerning electronegativity is correct?

- A. Electronegativity increases from left to right across a period.
- B. Metals generally have higher electronegativity values than non-metals.
- C. Electronegativity increases on descending a group.
- D. Noble gases have the highest electronegativity values.

9. Which statements are correct?

- I. Fluorine will react with potassium chloride solution to produce chlorine.
 - II. Iodine will react with sodium chloride solution to produce chlorine.
 - III. Bromine will react with lithium iodide solution to produce iodine.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

10. Which statement best describes ionic bonding?
- It is the electrostatic attraction between positive ions and delocalized electrons and occurs by the transfer of electrons.
 - It is the electrostatic attraction between positive ions and negative ions and occurs by the transfer of electrons.
 - It is the electrostatic attraction between positive ions and negative ions and occurs by the sharing of electrons.
 - It is the electrostatic attraction between positive nuclei and electrons and occurs by the sharing of electrons.
11. What are the correct formulas of the following ions?

	Nitrate	Sulfate	Phosphate	Hydrogencarbonate
A.	NO_3^-	SO_4^{2-}	PO_4^{3-}	HCO_3^-
B.	NO_3^-	SO_4^{2-}	PO_3^{3-}	HCO_3^{2-}
C.	NO_2^-	SO_4^-	PO_4^{3-}	HCO_3^-
D.	NO_2^-	SO_3^{2-}	PO_3^{3-}	HCO_3^{2-}

12. Which statements concerning the sodium chloride ionic lattice are correct?
- Sodium ions are larger than chloride ions.
 - Each sodium ion is surrounded by six chloride ions.
 - Each chloride ion is surrounded by six sodium ions.
- I and II only
 - I and III only
 - II and III only
 - I, II and III

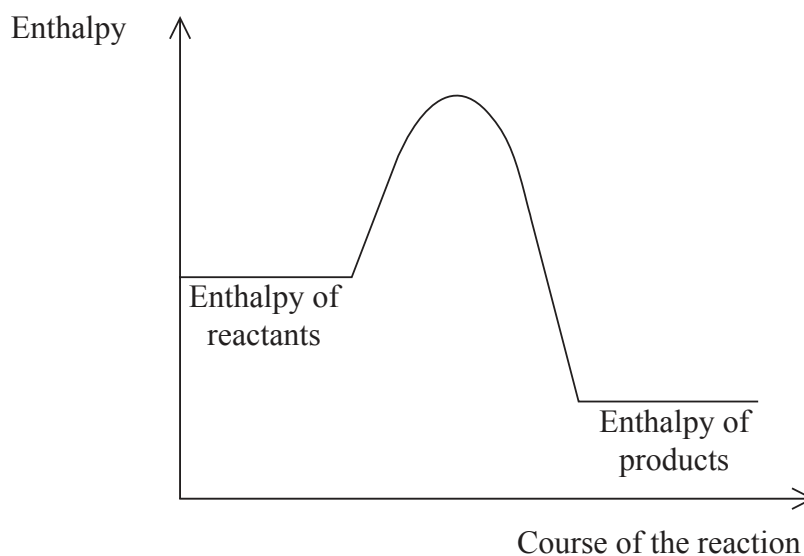
13. Which combination best describes the type of bonding present and the melting point of silicon and silicon dioxide?

	Silicon		Silicon dioxide	
A.	covalent bonding	high melting point	covalent bonding	high melting point
B.	metallic bonding	high melting point	covalent bonding	low melting point
C.	ionic bonding	high melting point	ionic bonding	low melting point
D.	covalent bonding	low melting point	ionic bonding	high melting point

14. Which statements are correct about hydrogen bonding?

- I. It is an electrostatic attraction between molecules.
 - II. It is present in liquid ammonia.
 - III. It is a permanent dipole-permanent dipole attraction.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

15. Which statement is correct for the enthalpy level diagram shown?



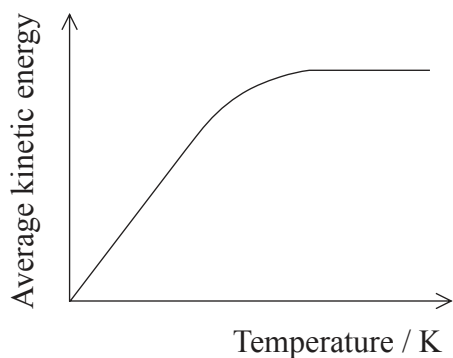
- A. The reaction is exothermic and the products are more stable than the reactants.
- B. The reaction is exothermic and the sign of the enthalpy change is positive.
- C. The reaction is endothermic and the sign of the enthalpy change is negative.
- D. The reaction is endothermic and the products are more stable than the reactants.

16. Which combination is correct about the energy changes during bond breaking and bond formation?

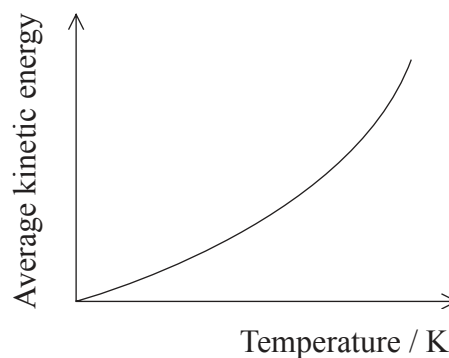
	Bond breaking	Bond formation
A.	exothermic	exothermic
B.	exothermic	endothermic
C.	endothermic	exothermic
D.	endothermic	endothermic

17. Which graph best represents the relationship between the average kinetic energy of molecules of a gas and temperature in K?

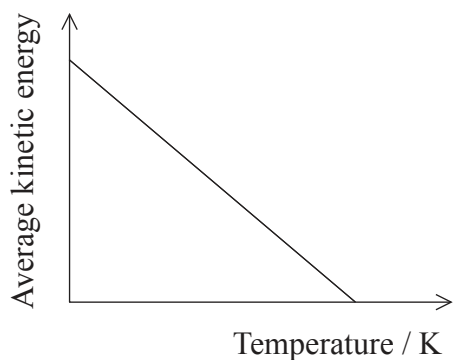
A.



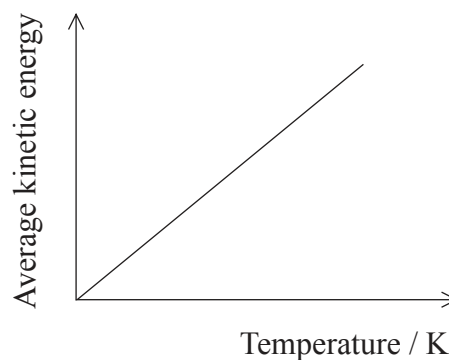
B.



C.



D.



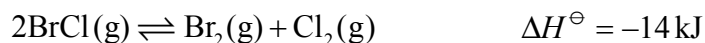
18. Which statement best describes and explains the effect of a catalyst on the rate of a chemical reaction?

- A. The rate increases because the frequency of collisions between particles increases.
- B. The rate increases because more colliding particles have the energy needed to react.
- C. The rate increases because the activation energy increases.
- D. The rate increases because more molecules are present.

19. The value of the equilibrium constant, K_c , for a reaction is 1.0×10^{-10} . Which statement about the extent of the reaction is correct?

- A. The reaction hardly proceeds.
- B. The reaction goes almost to completion.
- C. The products have a higher concentration than the reactants.
- D. The concentrations of reactants and products are the same.

20. Which changes occur when the temperature is decreased in the following equilibrium?



	Position of equilibrium	Value of K_c
A.	shifts to the right	decreases
B.	shifts to the right	increases
C.	shifts to the left	decreases
D.	shifts to the left	increases

21. Which is a characteristic property of sodium oxide?

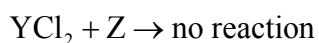
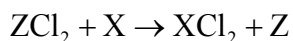
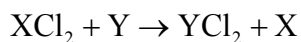
- A. It turns moist blue litmus paper red.
- B. It turns moist red litmus paper blue.
- C. When it dissolves in distilled water it forms a solution with pH less than 7.
- D. It reacts with magnesium metal.

22. A solution of acid HX has a pH = 1 and a solution of acid HY has a pH = 3. Which statement **must** be correct?
- A. HX is a stronger acid than HY.
 - B. HY is a stronger acid than HX.
 - C. The $[H^+]$ in the solution of HX is 100 times greater than the $[H^+]$ in the solution of HY.
 - D. The $[H^+]$ in the solution of HY is 100 times greater than the $[H^+]$ in the solution of HX.

23. Which statement is correct about a reducing agent?

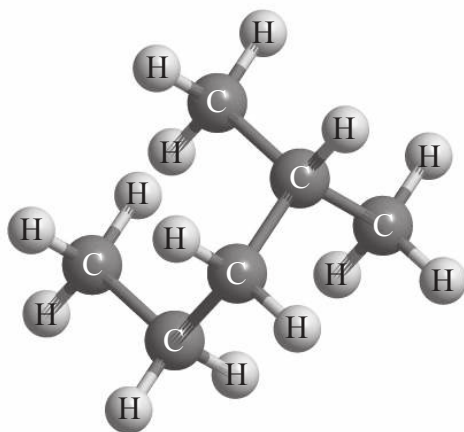
- A. It is reduced by gaining electrons.
- B. It is oxidized by gaining electrons.
- C. It is oxidized by losing electrons.
- D. It is reduced by losing electrons.

24. What is the correct **increasing** order of reactivity of the metals X, Y and Z based on the following information?



- A. $Z < X < Y$
- B. $Y < X < Z$
- C. $Z < Y < X$
- D. $X < Z < Y$

25. What is the name of the following molecule applying IUPAC rules?



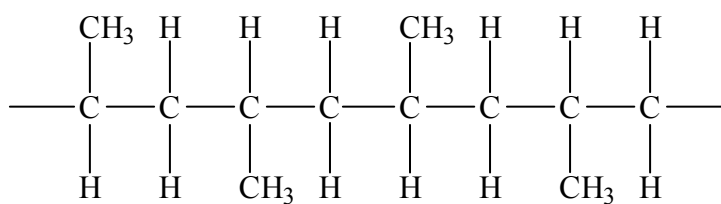
- A. 1,1-dimethylbutane
 - B. Hexane
 - C. 2-methylpentane
 - D. 4-methylpentane
26. How many non-cyclic structural isomers exist with the molecular formula C_5H_{10} ?
- A. 2
 - B. 3
 - C. 4
 - D. 5

27. Which steps are involved in the free-radical mechanism of the bromination of ethane in the presence of ultraviolet radiation?

- I. $C_2H_6 + Br\cdot \rightarrow C_2H_5\cdot + HBr$
- II. $C_2H_5\cdot + Br_2 \rightarrow C_2H_5Br + Br\cdot$
- III. $C_2H_5\cdot + Br\cdot \rightarrow C_2H_5Br$

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

28. Which substance can be polymerized to produce the polymer below?



- A. But-1-ene
- B. But-2-ene
- C. Propene
- D. 2-methylpropene

29. Which reagents can be used for the two-step conversion of ethene into ethanol?

	Step 1	Step 2
A.	HBr	acidified $\text{K}_2\text{Cr}_2\text{O}_7$
B.	HBr	aqueous KOH
C.	Br_2	acidified $\text{K}_2\text{Cr}_2\text{O}_7$
D.	Br_2	aqueous KOH

30. Which would be the best method to decrease the random uncertainty of a measurement in an acid–base titration?

- A. Ensure your eye is at the same height as the meniscus when reading the burette.
 - B. Use a different indicator for the titration.
 - C. Use a different burette.
 - D. Repeat the titration.
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