

國立宜蘭大學

107 學年度暑假轉學招生考試

(考生填寫)

准考證號碼：

化 學 試 題

《作答注意事項》

- 1.請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。
- 2.考試時間：80 分鐘。
- 3.本試卷共有 50 題選擇題，一題 2 分，共計 100 分。
- 4.請將答案寫在答案卷上（於本試題上作答者，不予計分）。
- 5.考試中禁止使用手機或其他通信設備。
- 6.考試後，請將試題卷及答案卷一併繳交。
- 7.本試卷採雙面影印，請勿漏答。
- 8.應試時不得使用電子計算機。

- 1) Green chemists reduce the risks associated with the manufacture of a product by doing all of the following **EXCEPT**
- A) using materials that are less toxic.
 - B) requiring workers to use protective equipment.
 - C) using smaller amounts of materials.
 - D) considering the biodegradability of chemicals used to make the product.
- 2) The acronym FLaReS is a mnemonic that helps us remember the rules that can be used to test a claim. Which of the following is **NOT** one of these rules?
- A) falsifiability
 - B) logic
 - C) replicability
 - D) societal acceptance
- 3) Chemist A claims that a new compound will inhibit the growth of a virulent strain of bacteria. When Chemist B from a different laboratory tests the compound against the same bacterial strain, the bacteria grow at their normal rate. Which of the following statements best describes what has happened?
- A) The claim is correct, because the test has been replicated.
 - B) The claim is incorrect, because the test has been replicated.
 - C) The claim is incorrect, because the test has not been replicated.
 - D) The claim is correct, because the data is not falsifiable.
- 4) A student measures 10.5 g of mercury(II) oxide into an open test tube and heats the tube. The heat causes the mercury(II) oxide to decompose into mercury and oxygen. After reaction, the student finds the mass of the contents of the tube to be 9.7 g. Which one of the following describes these observations?
- A) The decomposition of mercury(II) oxide does not obey the Law of Conservation of Mass.
 - B) 0.8 grams of oxygen gas are lost from the tube.
 - C) There are errors associated with the student's measurements.
 - D) Heating destroys some mass.
- 5) Hydrogen peroxide decomposes into water and oxygen when exposed to heat or light. A tightly capped bottle of hydrogen peroxide is placed on a mass scale (a balance) and exposed to light for three weeks. The mass reading on the scale does not change. This is an example of
- A) the Law of Conservation of Mass.
 - B) the Law of Definite Proportions.
 - C) the Law of Constant Composition.
 - D) the Law of Multiple Proportions.
- 6) CO_2 always contains 3 g of C for every 8 g of O. This is an example of
- A) Dalton's Atomic Theory.
 - B) Lavoisier's Law of Conservation of Mass.

- C) Dalton's Law of Multiple Proportions.
D) Proust's Law of Definite Proportions.
- 7) Which discovery was **NOT** in conflict with Dalton's atomic theory?
A) the discovery of electrical charge
B) the discovery of the electron
C) the discovery of the element gallium
D) the discovery of the proton
- 8) Perhaps the greatest triumph of Mendeleev's periodic table was
A) the use of rows and columns to organize the elements.
B) the ability to predict electron configurations of elements.
C) the use of atomic numbers as an organizing criterion.
D) the prediction of the existence of undiscovered elements.
- 9) The Periodic Table is helpful in all of the following endeavors but one. Which is the exception?
A) predicting formulas of compounds
B) predicting chemical reactivity of elements
C) predicting physical properties of elements
D) predicting monetary values of elements
- 10) Is it always possible to recycle and reuse materials?
A) Yes, because atoms cannot be destroyed in a chemical reaction.
B) Yes, because atoms can only be rearranged in a chemical reaction.
C) No, because atoms can be changed into other kinds of atoms.
D) No, if it is financially impracticable to do it.
- 11) Which is **NOT** true about the atomic number?
A) The atomic number of an element is the number of protons in an atom.
B) The atomic number of an element is equal to the positive charge of an atom's nucleus.
C) The atomic number of an element is equal to the number of electrons in a neutral atom.
D) The atomic number of an element is equal to the number of electrons in a charged atom.
- 12) When an electron moves from the ground state to the excited state, it
A) absorbs energy and moves closer to the nucleus.
B) absorbs energy and moves farther from the nucleus.
C) emits energy and moves closer to the nucleus.
D) emits energy and moves farther from the nucleus.
- 13) The designations s, p, d, f designate
A) different electron energy levels.

- B) different electron orbitals within an energy level.
C) different types of electrons.
D) valence electrons.
- 14) Which is an **IMPOSSIBLE** electron configuration?
A) $1s^2 2s^2$
B) $1s^2 2s^2 2p^4$
C) $1s^3 2s^2 2p^5$
D) $1s^2 2s^2 2p^6 3s^2$
- 15) The element with the ground state electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^5$ is
A) Ar.
B) Cl.
C) S.
D) Br.
- 16) Which orbital will have the **highest** energy?
A) 4d
B) 4f
C) 4p
D) 4s
- 17) A metalloid
A) is the same as a metal.
B) is located on the left side of the periodic table.
C) has properties intermediate between metals and nonmetals.
D) is in the center of the periodic table.
- 18) How does the periodic table substantiate atomic theory?
A) Both are theoretical and cannot support each other.
B) Groups in the periodic table have similar properties based on similar features of atomic structure, namely, the same number of valence electrons per atom.
C) All elements in a given period of the periodic table have the same number of valence electrons.
D) Mendeleev declared consistency between the periodic table and atomic theory.
- 19) Solid lithium hydride reacts with water to form aqueous lithium hydroxide and hydrogen gas. When this equation is written and balanced, the coefficient of lithium hydride is
A) 1.
B) 2.
C) 3.
D) 4.
- 20) Tin was among the first metals used by humans. Elemental tin is produced by

heating tin(IV) oxide, the principal ore of tin, with carbon. The products of this reaction are tin and carbon dioxide. When the equation is written and balanced, the coefficient of carbon is

- A) 1.
- B) 2.
- C) 3.
- D) 4.

21) Ammonia can be prepared by the reaction of magnesium nitride with water. The products are ammonia and magnesium hydroxide. When the equation is written and balanced, the coefficient of magnesium nitride is

- A) 1.
- B) 3.
- C) 6.
- D) 8.

22) The label which indicates that a substance is a gas is

- A) (g)
- B) (l)
- C) (s)
- D) (aq)

23) The observations that gaseous reactants combine to form gaseous products in volume ratios that are simple whole numbers is most directly summarized by which of the following.

- A) The Law of Conservation of Mass
- B) The Law of Fixed Proportions
- C) The Law of Multiple Proportions
- D) The Law of Combining Volumes

24) Which of the following is correct, according to Avogadro's hypothesis?

- A) At 0°C and 1 atm pressure, equal volumes of gases contain equal masses.
- B) At 0°C and 1 atm pressure, equal volumes of gases contain the same number of molecules.
- C) At 0°C and 1 atm pressure, equal volumes of gases have the same density.
- D) At 0°C and 1 atm pressure, 1 L of oxygen gas and 1 L of liquid water contain the same number of molecules.

25) Gay-Lussac's law of combining volumes states that the volumes of reactants and products are in small whole-number ratios. Which of the following is **NOT** an assumption for the law of combining volumes?

- A) The products and reactants must all be gases.
- B) The products and reactants must all be at the same temperature.
- C) The products and reactants must all be at the same pressure.
- D) The products and reactants must all be gases or liquids.

- 26) Which of the following does **NOT** contain Avogadro's number of particles?
- A) 1.0 mole of silver
 - B) 23 g of sodium
 - C) 6.02×10^{23} atoms of aluminum
 - D) 12 g of water
- 27) Nitroglycerin has a formula $C_3H_5(NO_3)_3$. The molar mass of nitroglycerin is
- A) 65 g/mole.
 - B) 227 g/mole.
 - C) 309 g/mole.
 - D) 398 g/mole.
- 28) Consider the following equation: $N_2 + 3 H_2 \rightarrow 2 NH_3$
Which of the following statements is **NOT** true for this equation?
- A) 3 mole of N_2 reacts with 9 moles of H_2 .
 - B) 1 L of N_2 reacts with 3 L of H_2 .
 - C) 3 gram of N_2 reacts with 9 grams of H_2 .
 - D) 2 molecule of N_2 reacts with 6 molecules of H_2 .
- 29) A solution that is 1 molar contains
- A) six moles of solute in 6 moles of solvent.
 - B) five moles of solute in 5 moles of solution.
 - C) six moles of solute in 600 g of solution.
 - D) four moles of solute in 4 liters of solution.
- 30) A solution contains 20 mL of ethanol in a total volume of 100 mL. The concentration of this solution is
- A) 2.0 M.
 - B) 2.0 % by mass.
 - C) 20 % by mass.
 - D) 20 % by volume.
- 31) The temperature at which a solid melts is the melting point of the solid. The melting point is an indication of the intermolecular forces that hold the solid together. Water melts at $0^\circ C$. Table sugar (sucrose) melts at $285^\circ C$. Gallium, Ga, melts at $30^\circ C$. Which one of the following ranks the intermolecular forces in these solids from the strongest to the weakest?
- A) Ga > water > sucrose
 - B) sucrose > Ga > water
 - C) water > sucrose > Ga
 - D) Ga > sucrose > water
- 32) The temperature at which a liquid boils is the boiling point of the liquid. The

boiling point is an indication of the intermolecular forces that hold the matter in the liquid state. Water, H_2O , boils at 100°C . Ethanol, $\text{C}_2\text{H}_6\text{O}$ boils at 78°C .

Ammonia, NH_3 , boils at -33°C . Which one of the following ranks the intermolecular forces in these liquids from the strongest to the weakest?

- A) Water > Ammonia > Ethanol
- B) Ammonia > Ethanol > Water
- C) Ethanol > Water > Ammonia
- D) Water > Ethanol > Ammonia

33) The temperature at which a solid melts is the melting point of the solid. The melting point is an indication of the intermolecular forces that hold a solid together. Aluminum melts at 660°C . Gold melts at 1064°C . Lead melts at 328°C . Which one of the following ranks the intermolecular forces in these solid elements from the strongest to the weakest?

- A) Au > Al > Pb
- B) Al > Au > Pb
- C) Pb > Au > Al
- D) Au > Pb > Al

34) The degree of order of matter is directly proportional to the cohesive forces that hold the matter together. In other words, the more organized the state of matter, the stronger the "glue" that holds it together. Which of the following ranks these cohesive forces from the state with the strongest to that with the weakest cohesive forces?

- A) gas > liquid > solid
- B) liquid > solid > gas
- C) solid > liquid > gas
- D) solid = gas = liquid

35) Water is a liquid at room temperature while methane is a gas. Which statement compares the intermolecular forces in these molecules correctly?

- A) The intermolecular forces in methane are stronger than those in water.
- B) The intermolecular forces in water are stronger than those in methane.
- C) Both water and methane have the same intermolecular forces.
- D) There is not enough information to compare these forces.

36) Which of the following is **NOT** a postulate of the kinetic-molecular theory?

- A) Molecules of a gas move rapidly and in straight lines.
- B) The molecules in a gas are tiny compared to the distance between them.
- C) The molecules of a gas are strongly attracted to each other.
- D) If two molecules collide with each other, the total energy of the molecules before the collision is the same as their total energy after the collision.

37) At STP, 1 mole of oxygen gas, O_2 , will have a mass of

- A) 16.0 g.

- B) 22.4 g.
C) 28.0 g.
D) 32.0 g.
- 38) For a given amount of gas at a constant temperature, the volume of gas varies inversely with its pressure is a statement of _____ Law.
A) Charles's
B) Avogadro's
C) Boyle's
D) Curie's
- 39) The statement that the volume of a fixed amount of a gas at a constant pressure is directly proportional to its absolute temperature is known as _____ Law.
A) Charles's
B) Boyle's
C) Gay-Lussac's
D) Avogadro's
- 40) At a given temperature and pressure, the volume of a gas is directly proportional to the amount of gas present. This is a statement of
A) Avogadro's Law.
B) Boyle's Law.
C) Charles's Law.
D) the Ideal Gas Law.
- 41) Assume that you have a sample of a gas. You know the volume, the temperature and the number of moles of the sample. Which of the following laws would you use if you wanted to calculate the pressure of the sample?
A) Boyle's Law
B) Charles's Law
C) Law of Combining Volumes
D) Ideal Gas Law
- 42) Which of the following is **NOT** true of the Arrhenius theory?
A) Acids are defined as compounds that produce H^+ ions in water solution.
B) Bases are defined as compounds that produce OH^- ions in water solution.
C) Arrhenius theory only applies to reactions in aqueous solution.
D) Acids are defined as compounds that produce OH^- ions in water solution.
- 43) When HCl is added to pure water, HCl molecules lose protons, while water molecules gain protons. In this reaction, HCl is a(n)
A) acid.
B) base.
C) salt.
D) solvent.

- 44) Which of the following ingredients would **NOT** be an active ingredient in an antacid?
- A) NaBr
 - B) Mg(OH)₂
 - C) NaHCO₃
 - D) CaCO₃
- 45) Lutefisk is a traditional Scandinavian food that is prepared by soaking a white fish, such as cod, in lye (NaOH). How does soaking the fish in lye "cook" it?
- A) A strong base will allow the fish to be heated to higher temperatures more quickly.
 - B) A strong base will break down or "denature" the protein in the fish.
 - C) A strong base will neutralize the fatty acids in the fish.
 - D) A strong base will raise the pH of blood in the fish.
- 46) The chemical basis of converting light into a photographic silver image is based on the fact that
- A) Ag⁺ exposed to light is easier to reduce to Ag than unexposed Ag⁺.
 - B) Ag⁺ exposed to light is more difficult to reduce to Ag than unexposed Ag⁺.
 - C) Ag⁺ exposed to light is easier to oxidize to Ag than unexposed Ag⁺.
 - D) Ag⁺ exposed to light is more difficult to oxidize to Ag than unexposed Ag⁺.
- 47) Which of the following is **NOT** true of a catalyst?
- A) A catalyst will speed up the rate of a reaction.
 - B) A catalyst will lower the activation energy for a reaction.
 - C) A catalyst is used up when it catalyzes a reaction.
 - D) A catalyst is not changed when it catalyzes a reaction.
- 48) Perfluorocarbons have been used in which of the following?
- A) temporary blood substitutes
 - B) nonstick cooking surfaces
 - C) oxygen solvent for treatment of premature babies
 - D) all of the above
- 49) This substance is an ester of the phenol group of salicylic acid with acetic acid and is commonly called
- A) aspirin.
 - B) Maalox.
 - C) Milk of Magnesia.
 - D) Tylenol.
- 50) The compound CH₃NH₂ is called
- A) methylamine.
 - B) dimethylamine.
 - C) trimethylamine.
 - D) methyl ammonia.