國　立　宜　蘭　大　學

104 學年度轉學招生考試

（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.本試卷共有選擇題 50 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) The most energy efficient method for converting biomass into useful energy is to
A) ferment sugars and starches from plants to form ethanol, which can be burned.
B) distill wood in the absence of air to form methanol, which can be burned.
C) use bacteria to break down plant material to produce methane.
D) burn the plant material directly.

2) Hydrogen gas has been proposed as a fuel of the future because
A) it can be obtained cheaply by drilling.
B) it can be extracted from seawater with no energy expenditure.
C) it is nonflammable.
D) it burns to produce water.

3) A fuel cell is an electrochemical device that
A) produces fuels from water.
B) burns gasoline to produce heat.
C) converts coal to a gas.
D) converts chemical energy directly to electrical energy.

4) Secondary treatment of wastewater is not effective for removal of
A) suspended matter.
B) dissolved organics.
C) nitrates and phosphates.
D) bacteria.

5) Charcoal filtration of wastewater is an excellent method for the removal of
A) dissolved ions.
B) organic molecules.
C) nitrates and phosphates.
D) sludge.

6) Advanced treatment of wastewater can include any of the following EXCEPT
A) charcoal filtration.
B) sand and gravel filtration.
C) phytoremediation.
D) reverse osmosis.

7) One of the results of ozone pollution in an urban environment is
A) destruction of glass windows.
B) decomposition of granite buildings.
C) cracking of sidewalks.
D) shortening the life of automobile tires.

8) A term that describes the relationship between O_2 and O_3 is
A) allotropes.
B) isomers.
C) conformers.
D) transformers.

背面尚有試題

9) Hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) are good substitutes for chlorofluorocarbons (CFCs) because
A) they are also greenhouse gases.
B) C-F bonds will react more easily with hydroxyl radicals, so they are broken down before they reach the stratosphere.
C) C-H bonds will react more easily with hydroxyl radicals, so they are broken down before they reach the stratosphere.
D) they are too heavy to reach the stratosphere.

10) Limestone is added to the iron producing mixture in a furnace to
A) add carbon to the mixture.
B) provide an additional reducing agent to extract all of the iron from the ore.
C) combine with silicates to remove impurities in the form of a slag.
D) produce a more corrosion resistant iron.

11) Steel is formed by
A) heating iron at high temperature for a long time.
B) combining iron, carbon and transition metals such as chromium and nickel.
C) oxidizing some of the iron to iron oxides.
D) adding sand and heating to a high temperature.

12) Which of the following statements about the corrosion of iron and aluminum is correct?
A) Aluminum reacts with oxygen to form an Al_2O_3 coating, which can flake off easily and allow more aluminum to undergo corrosion.
B) Iron reacts with oxygen to form an Fe_2O_3 coating, which can flake off easily and allow more iron to undergo corrosion.
C) Both aluminum and iron react with oxygen to form oxides which are hard and protect the metal from corrosion.
D) Aluminum corrodes more rapidly than iron does because it is lighter.

13) Radioisotopes have been used as tracers in a variety of applications because
A) radioactive isotopes of an element have the same chemical properties as nonradioactive isotopes.
B) it is easy to follow the movement of a radioactive isotope.
C) the decay products are easily detected.
D) all of the above are true.

14) Positron emission tomography (PET) is a
A) therapy for cancer using positrons.
B) diagnostic technique for monitoring dynamic processes in the body, such as brain activity.
C) device for containing a nuclear fusion reaction.
D) mechanism for transmutation of elements.

15) Technetium-99^m is a radioisotope used in a variety of diagnostic tests. Technetium-99^m has a short half-life (6 hr). The advantage of a short half-life for

diagnostic purposes is
A) the radioactivity is easier to monitor.
B) the radioactivity does not linger in the body.
C) the radioactivity lasts for a long time.
D) the chemical reactions induced by the technetium are more rapid.

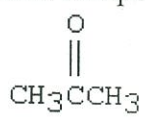
16) Which statement relating monomers and polymers is correct?
A) They have the same chemical and physical properties.
B) They have different chemical and physical properties.
C) The monomer is usually a solid, while the polymer is usually a liquid or gas.
D) They have the same chemical formula.

17) Which of the following characteristics of synthetic polymers is **NOT** a problem?
A) They frequently are neither biodegradable nor photodegradable.
B) They frequently give off poisonous gases when they are burned.
C) They generally have a high energy content and can be burned.
D) They make up a large volume of the waste which goes into landfills.

18) Polychlorinated biphenyls (PCBs) have been banned because they are an environmental hazard. Which of the following was **NOT** a reason for banning them?
A) PCBs degrade slowly in nature.
B) PCBs are nonpolar compounds and do not dissolve readily in water.
C) PCBs have high electrical resistance and are excellent insulating materials.
D) They lower the glass transition temperature, T_g, when they are added to a polymer.

19) Which of the following statements about industrial grade ethanol and the ethanol used in alcoholic beverages is **NOT** correct?
A) Industrial grade ethanol is made by reacting ethylene with water, while ethanol used in beverages is made by fermentation.
B) Industrial grade ethanol carries no federal excise tax, while ethanol used in beverages is taxed.
C) Industrial grade ethanol and ethanol used in beverages have different molecular structures.
D) Noxious substances are added to industrial grade ethanol so it is not safe to drink.

20) The compound below is a(n)



A) carboxylic acid.
B) aldehyde.
C) ketone.
D) alcohol.

21) The following multifunctional compound is a(n)

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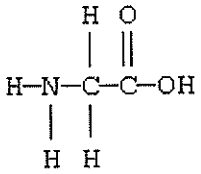
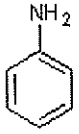


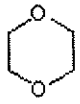
A) amino acid.
B) ester.
C) nucleic acid.
D) protein.

22) Which of the following is a heterocyclic compound?
A)

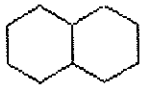


B)

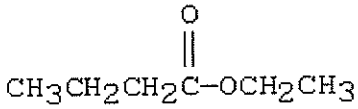
C)



D)



23) This compound is named



A) hexanone.
B) ethyl butyl ether.
C) butyl ethylate.
D) ethyl butyrate.

24) Which of the following is **NOT** a definition of reduction?
A) Reduction is the loss of oxygen from a substance.
B) Reduction is the addition of hydrogen to a substance.
C) Reduction is the loss of electrons from a substance.
D) Reduction is the gain of electrons by a substance.

25) A mixture of ammonium nitrate (NH_4NO_3) and fuel oil has often been used in terrorist attacks around the world. Which of the following statements is **NOT** true for this type of explosive mixture?
A) The materials are readily available to the general public.
B) It is very difficult to obtain the ammonium nitrate.
C) The ammonium nitrate serves as both an oxidizing agent and a reducing agent.

D) The reaction results in gaseous products and a huge increase in volume.

26) 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^+.

27) A substance which lowers the activation energy of a chemical reaction is called a(n)
A) reducing agent.
B) catalyst.
C) oxidizing agent.
D) carcinogen.

28) The pH of a sample of water from a river is 6.0. A sample of effluent from a food processing plant has a pH of 4.0. The concentration of hydronium ion in the effluent is
A) one and a half times (1.5x) larger than the river hydronium ion concentration.
B) two times (2x) larger than the river hydronium ion concentration.
C) four times (4x) larger than the river hydronium ion concentration.
D) 100 times (100x) larger than the river hydronium ion concentration.

29) Acid rain is caused by acidic pollutants in the air. Which of the following pollutants does **NOT** contribute to acid rain?
A) ammonia, NH_3
B) sulfur dioxide, SO_2
C) nitrogen dioxide, NO_2
D) nitric oxide, NO

30) The kinetic-molecular theory of gases assumes which of the following?
A) There are weak but significant interactions between gas molecules.
B) The total amount of energy will change when gas molecules collide.
C) The average kinetic energy of gas molecules will increase when you lower the temperature of the gas.
D) Gas molecules move constantly and in straight lines.

31) 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

32) 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.

背面尚有試題

B) Boyle's Law.
C) Charles's Law.
D) the Ideal Gas Law.

33) 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

34) Which one of the following reactions is **NOT** balanced?
A) $2\ CO + O_2 \rightarrow 2\ CO_2$
B) $2\ SO_2 + O_2 \rightarrow 2\ SO_3$
C) $2\ KNO_3 + 10\ K \rightarrow 5\ K_2O + N_2$
D) $SF_4 + 3\ H_2O \rightarrow H_2SO_3 + 4\ HF$

35) 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.

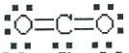
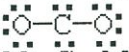
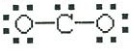
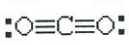
36) Molarity is a useful measure of concentration because
A) it is based on the Bronsted-Lowry definition of an acid.
B) it allows measuring out quantities of chemical particles through the use of volumes of solutions.
C) equal volumes of solutions of the same molarity will contain equal weights of solutes.
D) it allows the conversion of percentage concentrations (by weight) into a form easily used in chemical calculations.

37) Noble gases are unreactive because of their electronic structures. The kind of reasoning that states "if other elements could be made to achieve noble gas electronic structures they would be more stable" is called _____.
A) logic
B) inductive reasoning
C) deductive reasoning
D) critical thinking

38) Which of the following pairs is isoelectric?
A) Ar and Ne
B) Ar and Na^+
C) Ar and F^-

D) Ar and S^{2-}

39) The formula of sodium chromate is
A) $NaCrO_4$.
B) Na_2Cr.
C) Na_2CrO_4.
D) $Na_3(CrO_4)_2$.

40) The electron dot formula for carbon dioxide, CO_2, is
A) 
B) 
C) 
D) 

41) Which statement best summarizes the general nature of investigations during the **1800s** related to the acquisition and development of knowledge that provided glimpses into the atomic structure of matter?
A) Qualitative observations, although often influenced by ideas related to magic and mysticism, provide glimpses of the structure of matter.
B) Quantitative measurements, particularly those related to mass, lead to the formulation of fundamental laws leading to an atomic theory of matter.
C) The development and use of electrical probes to study matter lead to experimental evidence for the existence of subatomic particles in atoms.
D) The use of new experimental and mathematical techniques provided information concerning the organization of subatomic particles in atoms.

42) Elements in the **same period** have
A) the same atomic number.
B) the same number of neutrons.
C) the same number of valence electrons.
D) none of the above

43) 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 all of the above

44) 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.

背面尚有試題

45) Leucippus and Democritus believed that all of the following statements about matter were true **EXCEPT**
A) Matter was made up of atoms.
B) Each type of matter had a distinctive size and shape.
C) Matter was continuous.
D) Substances are mixtures of different kinds of atoms.

46) 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

47) 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, because the atoms may be spread so thinly that it would take too much time and energy to collect them and bring them back together.

48) DDT was widely used as an insecticide during and following World War II. However, the egg shells of birds that live in areas where DDT was used were very thin, and the young did not hatch. This is an example of the
A) Baconian dream.
B) Carsonian dream.
C) Baconian nightmare.
D) Carsonian nightmare.

49) Which of the following statements about the **size** of temperature units is **NOT** true?
A) 1 Celsius degree is equal to 1 kelvin.
B) 1 Celsius degree is bigger than 1 kelvin..
C) 1 kelvin is bigger than 1 Fahrenheit degree.
D) 1 Celsius degree is bigger than 1 Fahrenheit degree.

50) 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.