



## **FACULTY OF SCIENCE**

### **DEPARTMENT OF APPLIED CHEMISTRY NATIONAL DIPLOMA: SOMATOLOGY**

**MODULE**     SCI101  
                    SCIENCE I

**CAMPUS**     DFC

### **DECEMBER EXAMINATION**

**DATE:** 02/12/2014

**SESSION:** 11:30-14:30

**ASSESSORS**

Dr SP MALINGA  
Dr SP BVUMBI

**INTERNAL MODERATORS**

PROF S MISHRA  
MR MJ MVELASE

**DURATION:** 3 HOURS

**FULL MARKS:** 160  
**TOTAL MARKS:** 163

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**NUMBER OF PAGES:** 13 PAGES AND 3 ANNEXURES (PERIODIC TABLE AND PHYSICS FORMULA SHEET)

**INSTRUCTIONS:** CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT).  
ANSWER EACH SECTION IN A SEPARATE ANSWER SCRIPT.  
THE QUESTION PAPER MUST BE HANDED IN WITH THE ANSWER SCRIPTS.

**REQUIREMENTS:** TWO UJ MULTIPLE CHOICE ANSWER SHEET.  
TWO ANSWER SCRIPTS.

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**INSTRUCTIONS TO STUDENTS:**

1. This paper consists of **two parts**:  
PART A: CHEMISTRY (Section 1: Multiple Choice Questions and Section 2: Long Questions).  
PART B: PHYSICS (Section 1: Multiple Choice Questions and Section 2: Long Questions).
  2. You will receive **2 multiple choice answer sheets** – one for **Part A** and one for **Part B**. Please complete your personal information on the front of the multiple choice answer sheet and **clearly indicate** on the multiple choice answer sheet **if it is used for Part A or Part B**.
  3. You will receive **two answer scripts** for answering the long questions – one for **Part A** and one for **Part B**. Please complete your personal information on the front of the script and **clearly indicate** on the script **whether it is used for Part A or Part B**.
  4. **THE QUESTION PAPER MUST BE HANDED IN WITH THE TWO ANSWER SCRIPTS ALONG WITH THE MULTIPLE CHOICE ANSWER SHEETS.**
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**PART A: CHEMISTRY****SECTION 1**

- *Answer the multiple choice questions on the supplied multiple choice answer sheet by shading the block corresponding to the correct option, preferably using a soft pencil.*
1. Which of the following describes the **correct** characteristics of gases?
    - A. Have no fixed shape, but have fixed volume; molecules far apart which makes gases flow easily.
    - B. Have no fixed shape or fixed volume; molecules are far apart which makes gases able to flow and be compressed.
    - C. Have no fixed shape and take volume of container; molecules arranged in definite pattern makes gases flow and be compressible.
    - D. Have no fixed volume and no fixed shape; with molecules relatively close together, so they can be compressed.
  2. Which of the following are **all** examples of physical means of separation?
    - A. Filtration, evaporation, distillation, heat, magnetism
    - B. Filtration, neutralisation, distillation, magnetism, heat
    - C. Evaporation, combustion, selective filtration, distillation
    - D. Distillation, evaporation, neutralisation, combustion, heat

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3. Which of the following is **not** an example of a chemical change?
- A. Combustion
  - B. Distillation
  - C. Hydrolysis
  - D. Electrolysis
4. The periodic table is ...
- A. the systematic arrangement of elements into rows and columns in order of increasing numbers due to their chemical reactions.
  - B. a random arrangement of elements which was discovered to have elements with similar properties grouped in rows.
  - C. the systematic arrangement of elements according to their atomic numbers into groups and periods depending on their properties.
  - D. elements arranged into a pattern so that each group has 8 electrons.
5. The octet rule states that....
- A. molecules tend to lose, gain or share electrons until they have eight electrons in all shells.
  - B. atoms tend to lose, gain or share electrons until they become noble gases.
  - C. bonded atoms tend to lose, gain or share electrons until they each have at least a share of eight valence electrons.
  - D. bonded atoms tend to lose, gain or share electrons until they have only eight electrons in their shells.
6. Choose the **correct** statement regarding the structure of atoms.
- A. The nucleus consists of positively charged protons and neutral neutrons, with negatively charged electrons moving around it.
  - B. The nucleus consists of negatively charged protons and neutral neutrons, with positively charged electrons moving around it.
  - C. The nucleus consists of negatively charged protons, with neutrons and positively charged electrons moving around it.
  - D. Atoms are neutral due to the presence of neutrons that neutralise all the charges of protons and electrons.
7. Which of the following is **incorrect**? The atomic number of an element
- A. corresponds to the number of protons and neutrons present in the nucleus.
  - B. corresponds to the number of protons present in the nucleus.
  - C. identifies the element.
  - D. is the same as the number of electrons in a neutral atom of the element.
8. Ionic bonds are formed when.....
- A. valence electrons are shared between atoms.
  - B. each of the ions is neutral because the total number of electrons remains unchanged.
  - C. valence electrons are transferred between one atom and another.
  - D. the compound  $\text{CO}_2$  is an example of an ionic substance.

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9. The charge of the sulphur ion is
- A. +2
  - B. -2
  - C. +3
  - D. +1
10. Isotopes are ...
- A. atoms of the same element with different number of protons.
  - B. atoms of the same element that have different number of neutrons.
  - C. atoms with the same number mass number, but different atomic number.
  - D. atoms that weigh more due to their charges.
11. Which of the following statements is **incorrect?** The reason that ice floats is that
- A. ice is less dense than water.
  - B. ice has a higher mass per unit volume.
  - C. when water freezes it expands.
  - D. the water molecules of ice are arranged in hexagonal patterns.
12. Which of the following is **not true** about strong acids?
- A. dissociate fully in water to produce a lot of  $H^+$  ions
  - B. dissolve some metals like iron to produce hydrogen gas
  - C. have pH's close to 1
  - D. have a lot of acid dissolved per unit volume when compared to weak acids
13. The bases potassium hydroxide and aniline are
- A. strong and weak respectively
  - B. weak and strong respectively
  - C. both weak
  - D. both strong
14. Which of the following is **false?** A solution is "saturated" when ...
- A. it contains the maximum amount of dissolved solute possible under normal conditions at a given temperature.
  - B. the rate at which the solute is dissolving equals the rate at which it returns from solution.
  - C. no more solute will dissolve unless the temperature is raised.
  - D. it contains more than the equilibrium amount of solute at a given temperature.
15. Which of the following would **increase** the solubility of an ionic substance?
- A. A decrease in density of the solute.
  - B. An increase in temperature.
  - C. The addition of a non-polar solvent.
  - D. A reduction in the surface area of the solute.

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16. When a nonvolatile solute is dissolved in a solvent, the boiling point of the solution is \_\_\_\_\_ and the freezing point of the solution is \_\_\_\_\_ than the solvent on its own.
- A. higher / higher  
B. higher / lower  
C. lower / higher  
D. lower / lower
17. Crystalline substances that release moisture into the air rather than absorbing it, are said to be
- A. hygroscopic  
B. desiccants  
C. efflorescent  
D. drying agents
18. Which of the following combinations is miscible?
- A. water and oil  
B. water and alcohol  
C. water and hexane  
D. water and chloroform
19. What type of bonds exists between water molecules?
- A. Ionic bonds  
B. Polar covalent bonds  
C. Hydrogen bonds  
D. Non-polar covalent bonds
20. The zig-zag random movement of colloidal particles within the dispersing medium is called:
- A. Irregular movement  
B. Brownian movement  
C. Tyndall movement  
D. Raoult movement
21. What do we call the reaction of an acid with a base?
- A. Neutralisation  
B. Oxidation  
C. Amphoteric  
D. Reduction
22.  $\text{Ag}^+$  and  $\text{SO}_4^{2-}$  combine to form a salt with the formula
- A.  $\text{AgSO}_4$   
B.  $\text{Ag}_2\text{SO}_4$   
C.  $\text{AgS}_2\text{O}_4$   
D.  $\text{Ag}_2^+\text{SO}_4^{2-}$

23. When a substance dissolves in water, the following happens:
- A. The cations and anions of the substance repel each other and move apart.
  - B. The cations will be strongly attracted to the hydrogen atoms of the water molecules.
  - C. The oxygen and hydrogen ends of the water molecules respectively pull the cations and anions of the substance apart.
  - D. The water molecules will surround the anions of the substance with their oxygen ends facing the anions, thereby pulling them apart from the cations.
24. When we say that water is amphoteric, we mean that
- A. it dissociates to form negative hydronium ions and positive hydroxide ions.
  - B. if it is added to an acid or to a base, water will always form a salt.
  - C. water has the ability to neutralise weak acids and bases.
  - D. it is both an acid and a base at the same time and in equal proportion.
25. Which of the following statements about strong acids is **false**?
- A. Strong acids dissociate fully in water to produce a lot of  $H^+$  ions.
  - B. Strong acids dissolve some metals like iron to produce hydrogen gas.
  - C. Strong acids have pH values close to 1.
  - D. Strong acids have a lot of acid dissolved per unit volume when compared to weak acids.
26. Which of the following statements is **false**?
- A. When oxidation occurs, reduction must also occur in equal amounts.
  - B. A solution of copper ions will oxidise zinc metal placed in it.
  - C. Oxygen and hydrogen have to be present for redox reactions to occur.
  - D. Hydrogen peroxide is an oxidising agent.
27. When methane gas is burned, it undergoes the following reaction:  $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ . Which of the following statements is **true**?
- A. Oxygen has been oxidised.
  - B. Carbon dioxide has been reduced.
  - C. Water has been reduced.
  - D. Methane has been oxidised.
28. In the reaction between zinc and copper ions according to the following equation,
- $$Zn (s) + Cu^{2+} (aq) \rightarrow Zn^{2+} (aq) + Cu (s)$$
- A. electrons have been transferred from the copper to the zinc.
  - B. the copper has been oxidised.
  - C. electrons have been transferred from the zinc to the copper.
  - D. the zinc has been reduced.

29. Products used for lightening the hair or skin usually contain

- A.  $\text{H}_2\text{O}$
- B.  $\text{NaClO}$
- C.  $\text{PbS}$
- D.  $\text{H}_2\text{O}_2$

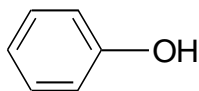
30. Choose the **false** statement from the following.

- A. Alkanes have only single bonds.
- B. When chlorine reacts with ethane it attaches itself onto one of the hydrogen atoms.
- C. The names of compounds in the alkene family end in -ene.
- D. Unsaturated hydrocarbons react by addition.

31. Menthol is ...

- A. an aromatic alcohol
- B. a secondary alcohol
- C. a tertiary alcohol
- D. a cyclic alcohol

32. Identify the following compound:



- A. phenol
- B. ethanol
- C. menthol
- D. benzanol

33. Choose the **incorrect** statement from the following.

- A. Ethers were used as anaesthetics.
- B. Ethers are inorganic solvents used in solvent extraction.
- C. Ethers are very flammable.
- D. Ethers can be toxic to the body.

34. Which of the following represents an aldehyde?

- A.  $\text{RCOOR}'$
- B.  $\text{ROH}$
- C.  $\text{RCHO}$
- D.  $\text{ROR}'$

35. When a long chain fatty acid is reacted with a strong base like  $\text{NaOH}$ , the resultant product is

- A. An ester
- B. Soap
- C. Acetone
- D. A polymer

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36. A typical soap molecule has
- A. a hydrophilic tail and a hydrophobic head.
  - B. a positive head and a negative tail.
  - C. a polar tail and a nonpolar head.
  - D. an anionic head and a hydrocarbon tail.
37. The chemical formula for acetone is
- A.  $\text{CH}_3\text{COOH}$
  - B.  $\text{CH}_3\text{COCH}_3$
  - C.  $\text{CH}_3\text{CHO}$
  - D.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
38. Ethers are formed by....
- A. oxidation of an inorganic acid
  - B. the addition of a strong base
  - C. oxidation of an aldehyde
  - D. reacting an alcohol with sulphuric acid
39. A by-product in the commercial manufacturing of soap is
- A. ethylene glycol
  - B. menthol
  - C. propanol
  - D. glycerol
40. Amines are compounds that..
- A. can be reduced to form ammonia.
  - B. are widely found in mineral deposits.
  - C. have basic properties.
  - D. have acidic properties.
41. Which of the following is **incorrect**? Hard water contains dissolved minerals that
- A. react with soap and form precipitates which make fabrics rough and streaky.
  - B. react with soap and cause the soap to produce more foam.
  - C. cause deposits of salts in kettles, geysers and pipes.
  - D. react with soap and form rings around bathtubs.
42. Which of the following statements is **false**?
- A. Starch is stored in the liver.
  - B. Starch is hydrolysed to form glucose.
  - C. Starch is a polysaccharide.
  - D. Starch can be tested for by using iodine.



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**SECTION 2****QUESTION 1**

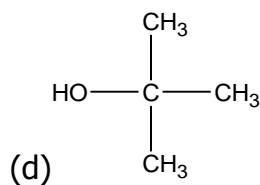
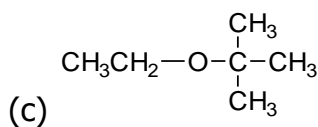
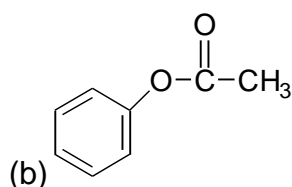
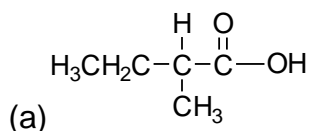
- 1.1 Give the Lewis symbol of the following elements: Sulphur, Boron, Bromine and Calcium. (4)
- 1.2 Use a labelled diagram to explain what is meant by the statement 'Water is a polar molecule'. (4)
- 1.3 Describe the process of *distillation* that is used to purify water. (4)
- 1.4 Write the chemical formula of the following polyatomic ions. (4)
- a) sulphate
  - b) phosphate
  - c) hydrogen carbonate
  - d) nitrate

**[16]**

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**QUESTION 2**

- 2.1 Petroleum is a complex mixture of hydrocarbon. What is meant by the term *hydrocarbon*? (2)
- 2.2 List two uses of hydrocarbons and give applicable examples. (4)
- 2.3 Give the names of the functional groups for the following organic compounds. (4)

**[10]**

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**QUESTION 3**

- 3.1 Perfumes are characterised by the presence of notes. Describe what a *top note* is and give its typical component. (3)
- 3.2 List three processes used in the extraction of floral oils. (3)
- 3.3 Distinguish between a *deodorant* and *antiperspirant*. (4)

**[10]**

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**MARKS PART A: 120**

**PART B: PHYSICS****SECTION 1**

- Answer the multiple choice questions on the supplied multiple choice answer sheet by shading the block corresponding to the correct option, preferably using a soft pencil.
- **Clearly indicate** on the multiple choice answer sheet that this is the multiple choice answer sheet for **Part B: Physics**.

1. Which one of the following is an SI base unit for distance?
  - A. Meter
  - B. Newton
  - C. Kilogram
  - D. Centimeter
2. Which of the following choices is equivalent to  $8 \text{ mm}^3$ ?
  - A.  $8 \times 10^{-3} \text{ m}^3$
  - B.  $8 \times 10^{-9} \text{ m}^3$
  - C.  $8 \times 10^{-6} \text{ m}^3$
  - D.  $8 \times 10^9 \text{ m}^3$
3. Which of the following is the SI unit of temperature?
  - A. Kilograms
  - B. Centigrade
  - C. Kelvin
  - D. Joules
4. The following will occur by adding or removing heat from an object
  - A. Change in shape or size
  - B. Change in Temperature
  - C. Change in phase
  - D. Both A, B and C are correct
5. A thermometer is used as an instrument for measuring
  - A. Hotness or coldness
  - B. Atmospheric pressure
  - C. Temperature
  - D. Atmosphere
6. The SI unit for specific heat capacity is
  - A.  $\text{J} \cdot ^\circ\text{C}^{-1}$
  - B.  $\text{J} \cdot \text{kg}^{-1}$
  - C.  $\text{J} \cdot \text{kg}^{-1} \cdot ^\circ\text{C}^{-1}$
  - D. Joule

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7. The process whereby vapour changes to liquid is called?
- A. Melting
  - B. Condensation
  - C. Sublimation
  - D. Boiling
8. One of the laws of reflection of light states that
- A. the incident ray is equal to the reflected ray
  - B. the angle of incidence is equal to the angle of refraction
  - C. the incident ray, normal and the refracted ray all lie in the same plane
  - D. the angle of incidence is equal to the angle of reflection

**[8 × 2 = 16]**

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**SECTION 2****QUESTION 1**

- 1.1 Define *density*. (2)
- 1.2 Calculate the mass (in g) of platinum with a volume of  $50 \text{ cm}^3$  if the density of platinum is  $21,4 \text{ g cm}^{-3}$ . (3)
- 1.3 An empty RD bottle has a mass of 20 g, filled with water 70 g and filled with spirits 64 g. Calculate the RD of spirits. (4)
- 1.4 State two laws of pressure in liquids. (2)
- 1.5 A woman's weight is 500 N. She wears high heeled shoes of which the heels have dimensions 10 mm x 10 mm. Calculate the pressure exerted on the floor if she stands with her full weight on one heel. (4)

**[15]**

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**QUESTION 2**

- 2.1 Define *linear expansivity*. (2)
- 2.2 A telegraph wire has a length of 30 m and is made of metal of linear expansivity  $2 \times 10^{-5} \text{ K}^{-1}$ . Calculate the change in length if the temperature varies from  $30^\circ\text{C}$  to  $-5^\circ\text{C}$ . (3)
- 2.3 State two properties of all electromagnetic waves (2)
- 2.4 State two differences between a *real image* and a *virtual image*. (2)
- 2.5 The speed of light in water is  $2,25 \times 10^8 \text{ m s}^{-1}$ . Determine the refractive index of water. (3)

**[12]**

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**TOTAL MARKS PART B: 43****FULL MARKS PART B: 40**