education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES P2 (CHEMISTRY)

NOVEMBER 2006

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages, a 1-page answer sheet and a periodic table.

INSTRUCTIONS AND INFORMATION

1. Write your name and/or examination number (and centre number if applicable) in the space provided on the ANSWER SHEET and ANSWER BOOK.

2. Answer ALL the questions.

3. Answer SECTION A on the attached ANSWER SHEET.

4. Answer SECTION B in the ANSWER BOOK.

5. Non-programmable calculators may be used.

6. Appropriate mathematical instruments may be used.

7. Number the answers correctly according to the numbering system used in this question paper.

8. Wherever motivation, discussion, et cetera is required, be brief.

SECTION A

Answer this section on the attached ANSWER SHEET.

QUESTION 1: ONE-WORD ANSWERS

Write only the correct word/term for each of the following descriptions next to the question number (1.1 - 1.5). In some questions you may need to choose from the terms given in brackets.

1.1   Oceans, lakes, rivers, ice caps et cetera on earth form the ... sphere.   (1)

1.2   Melting points, boiling points and densities of substances are classified as (physical/chemical) properties.   (1)

1.3   The particles within diamonds are held together by (covalent/ionic) bonds.   (1)

1.4   Absorbed infra-red radiation can cause (physical/chemical) changes in a substance.   (1)

1.5   The measure of the average kinetic energy of particles in a substance.   (1)
                                                                                                                      [5]

QUESTION 2: MATCHING ITEMS

Match the information in COLUMN A with the information in COLUMN B by writing only the letter (A -J) next to the question number (2.1 - 2.5).

COLUMN A		COLUMN B	
2.1	Electron configuration of the Na^+ ion	A	number of unpaired electrons in the outermost energy level of an atom
2.2	SO_4^{2-}	B	nitrogen cycle
2.3	Valence electrons	C	conservation of atoms
2.4	Chemical reaction	D	$1s^2\, 2s^2\, 2p^6$
2.5	A global cycle that consists of physical changes only	E	sulphate ion
		F	total number of electrons in the outermost energy level of an atom
		G	$1s^2\, 2s^2\, 2p^6\, 3s^2$
		H	conservation of molecules
		I	sulphite ion
		J	water cycle

[5]

QUESTION 3: TRUE OR FALSE

Indicate whether the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question number (3.1 - 3.5). If the statement is FALSE, write down the correct statement.

3.1   The electrical conductivity of metalloids (semi-metals) increases with
          decreasing temperature.   (2)

3.2   Ionisation energy is the amount of energy given off by an atom in the gaseous
          phase when an electron is released.   (2)

3.3   Molecules form because they are more stable than individual atoms.   (2)

3.4   Every time potatoes are harvested from a section of soil, some nitrogen is lost
          from the soil.   (2)

3.5   Explosions can cause bodily harm because they are endothermic reactions.   (2)

[10]

QUESTION 4: MULTIPLE-CHOICE QUESTIONS

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the answer, which in your opinion is the correct or best one, and mark the appropriate block with a cross (X).

4.1   Water can be classified as a(n) …

   A   element.

   B   compound.

   C   homogeneous mixture.

   D   heterogeneous mixture.   (3)

4.2   Which ONE of the following regarding the thermal conductivity and electrical conductivity of metals is TRUE?

	Thermal conductivity	Electrical conductivity
A	Good	Good
B	Good	Poor
C	Poor	Good
D	Poor	Poor

(3)

4.3   The jam in a hot jam tart always feels hotter than the pastry because …

   A   pastry absorbs latent heat from the jam.

   B   jam has a higher specific heat capacity than pastry.

   C   pastry has a higher specific heat capacity than jam.

   D   jam absorbs latent heat from the pastry.   (3)

4.4   A compound consists of the ions A^{3+} and B^{2-}. A possible formula of the compound could be …

   A A_3B_2.

   B A_2B_3.

   C $(AB)_6$.

   D   2A3B.   (3)

4.5   Twenty five grams (25 g) of reactant P reacts completely with forty five grams (45 g) of reactant Q. Which ONE of the following statements is CORRECT?

A   The total mass of products will be equal to 70 g.

B   The total mass of products plus any unreacted reactants will be 70 g.

C   The total mass of products plus any unreacted reactants will be less than 70 g.

D   The total mass of products plus any unreacted reactants will be greater than 70 g.   (3)
[15]

TOTAL SECTION A: 35

SECTION B

INSTRUCTIONS

1.   Answer this section in the ANSWER BOOK.

2.   In ALL calculations, formulae and substitutions must be shown.

3.   Round off your answers to TWO decimal places.

QUESTION 5

5.1   Write down the chemical formulae of the following:

5.1.1   Sodium chloride   (1)
5.1.2   Copper(II) sulphate   (1)

5.2   What is the household (common) name of sodium chloride?   (1)

5.3   Write down the name of the group of metals to which copper belongs.   (1)

An investigation is carried out to determine the mass of sodium chloride and copper(II) sulphate that can dissolve in the same volume of water at different temperatures. The results obtained are shown on the graph below.

Graph of solubility versus temperature
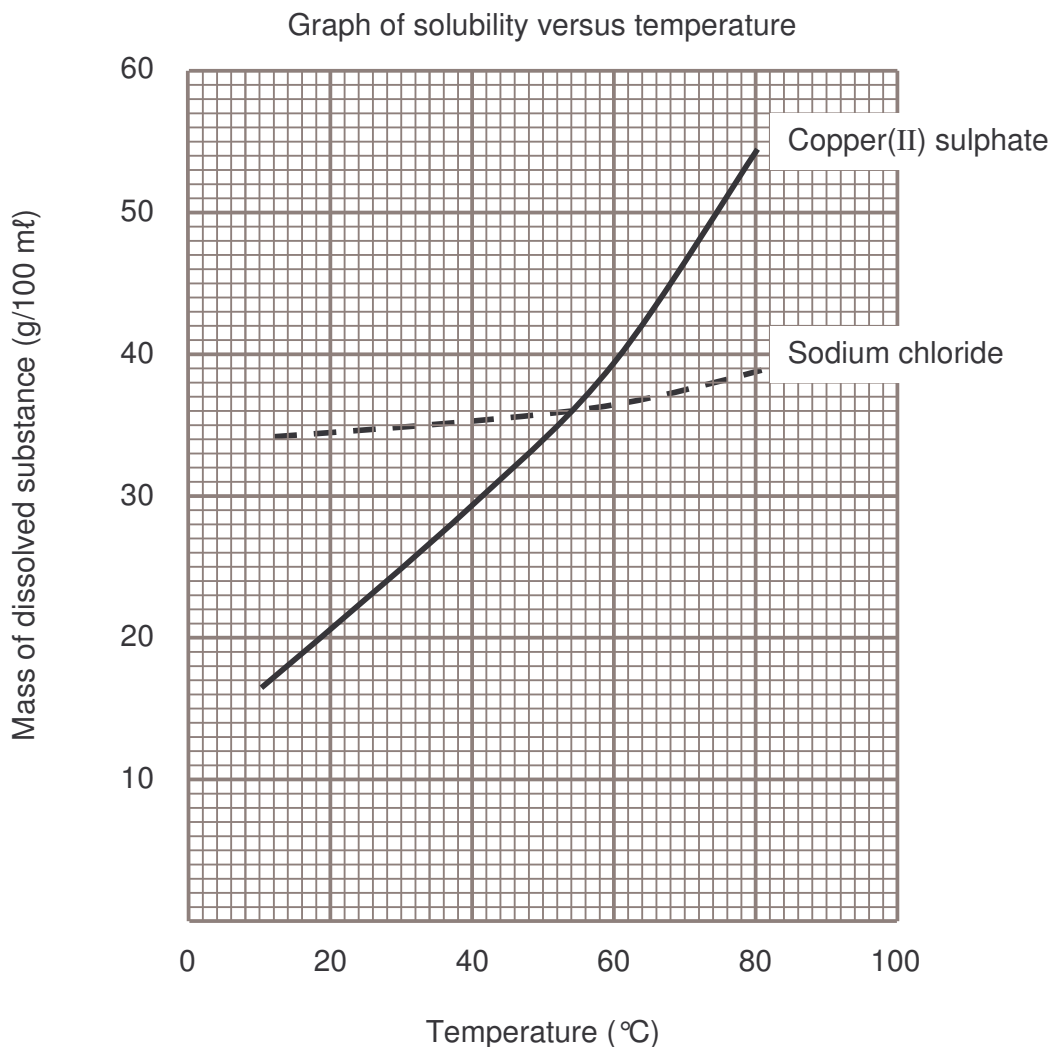
Use the graph to answer the following questions:

5.4   Write down the factor that was kept constant during the investigation.   (2)

5.5   Which ONE of the two substances is more soluble at room temperature
        (25 °C)?   (2)

5.6   Write down the temperature at which the solubility of these substances is
        equal.   (2)

5.7   What mass of the salts is soluble at the temperature mentioned in
        QUESTION 5.6?   (2)

5.8   What conclusion can you draw from the graph about the solubility of
        copper (II) sulphate?   (2)

        [14]

QUESTION 6

Uranium is found in two *isotopic* forms: uranium-235 $\left(^{235}_{92}U\right)$ and uranium-238 $\left(^{238}_{92}U\right)$. Enriched uranium-235, which is highly reactive, is used in the generation of electricity and in nuclear weapons. When a country acquires enriched uranium-235, their neighbouring countries become nervous and suspicious.

Uranium-235 makes up approximately 0,7% of the total uranium content on earth. Stable uranium-238, which is not suitable for use in nuclear reactors, makes up 99,3%.

6.1   Define the term 'isotope'.   (2)

6.2   Explain why $^{238}_{92}U$, although more abundant, is not suitable for use as fuel in nuclear reactors.   (2)

6.3   Calculate the relative atomic mass of uranium.   (4)

6.4   Copy the table in your answer book. Tabulate ONE benefit and ONE disadvantage of $^{235}_{92}U$ to humanity.

Benefit of $^{235}_{92}U$ to humanity	Disadvantage of $^{235}_{92}U$ to humanity

                                                                                                     (4)
                                                                                                    [12]

QUESTION 7

Boiling points and melting points of substances are a measure of the strength of intermolecular forces. The table below shows the melting points and boiling points of the hydrides of Groups 4 (IV) and 6 (VI).

Hydrides of Group 4 (IV)	Melting point (°C)	Boiling point (°C)	Hydrides of Group 6 (VI)	Melting point (°C)	Boiling point (°C)
CH_4	-182	-164	H_2O	0	+100
SiH_4	-185	-112	H_2S	-85	-61
GeH_4	-165	-89	H_2Se	-60	-42
SnH_4	-150	-52	H_2Te	-49	-2

7.1   Draw two water molecules. Use your diagram to explain the difference between intermolecular and intramolecular forces.   (4)

7.2   Refer to the boiling points of CH_4 and SiH_4. Which hydride has stronger intermolecular forces?   (2)

7.3   Molecular size increases from top to bottom in a group. What is the relationship between boiling points and the size of molecules in Group 4 (IV)?   (2)

7.4   Do the boiling points of the hydrides of Group 6 (VI) follow the same pattern
        as the boiling points of the hydrides of Group 4 (IV)? Explain your answer.   (3)

7.5   Write down the phase for each of the hydrides of Group 6 (VI) at room
        temperature (25 °C).   (2)

7.6   Water has a difference of 100 °C between its melting point and boiling point.
        Explain how this property is useful in sustaining life on earth.   (2)

        [15]

QUESTION 8

Copy the table shown below into your answer book. Write each of the items below
under the correct heading:

  •   Fermentation of mealie meal
  •   Boiling of water
  •   Frying an egg
  •   Burning of petrol
  •   Sublimation of dry ice

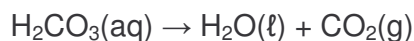| PHYSICAL CHANGE	CHEMICAL CHANGE

[5]

QUESTION 9

Write balanced chemical equations for each of the following descriptions:

9.1   The carbon monoxide gas from motorcar engines combines with the oxygen
        gas in the air to produce carbon dioxide gas.   (3)

9.2   When sulphur dioxide gas combines in the atmosphere with water vapour it
        causes acid rain.   (3)

9.3   Natural gas is mainly methane (CH_4). When this gas burns in oxygen, carbon
        dioxide gas and water are produced.   (3)

        [9]

QUESTION 10

Fizzy drinks and soda water contain carbonic acid (H_2CO_3). When a can of fizzy drink is opened, water and carbon dioxide gas are released. A simplified equation for the reaction is:

Ingredients: Carbonated Water, Sugar, Caramel, Colouring, Flavourings, Phosphoric Acid, Preservative – Sodium Benzoate, Caffeine, Artificial Sweetener Saccharin

2 Litres

5 010497 200017   NO RETURN NO DEPOSIT

$$H_2CO_3(aq) \rightarrow H_2O(\ell) + CO_2(g)$$

10.1   Is this reaction a synthesis or a decomposition reaction?   (1)

10.2   Use this equation and explain why fizzy drinks can cause burping (belching).   (2)

10.3   Some people say that fizzy drinks have a harmful effect on the teeth, causing tooth decay. How would you investigate this? Include the following in your report:

    •   The investigative question
    •   How you would carry out this investigation (Method)
    •   What you would look for (Results)
    •   How you would interpret your results (Conclusion)   (5)
                                                                                                        [8]

QUESTION 11

Methane (CH_4) is a gas produced by decaying organic matter.

11.1   State the Law of Constant Composition.   (2)

11.2   Calculate the percentage carbon and hydrogen in methane.   (4)

11.3   What should be the percentage composition of carbon in a 10 g sample of methane gas?   (2)
                                                                                                        [8]

QUESTION 12

Test tubes **X** and **Y** each contain 20 cm^3 of hydrochloric acid (HCℓ).

Powdered sodium hydrogen carbonate (sodium bicarbonate, $NaHCO_3$) is added to test tube **X**.

The same mass of sodium carbonate (Na_2CO_3) is added to test tube **Y**.

The following results are recorded:

TEST TUBE X	TEST TUBE Y
Effervescence (bubbles form)	Effervescence (bubbles form)
Colourless solution	Colourless solution
Test tube feels warm	Test tube feels cold

12.1   In which test tube does an exothermic reaction take place?   Explain your answer.   (3)

12.2   Complete and balance the equation:

$$Na_2CO_3 + HCℓ \rightarrow \underline{\hspace{2cm}} + H_2O + CO_2$$ (3)

[6]
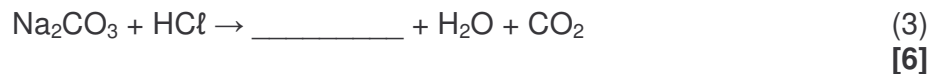
QUESTION 13

                During strenuous exercise athletes sweat.   In this process, the breeze helps their bodies to cool down.

13.1   Explain the meaning of *latent heat*.   (3)

13.2   Explain how the breeze helps athletes' bodies cool down when they sweat.   (2)

13.3   Copy the diagram below in your answer book. During the cooling process the molecules undergo a phase change.   Use circles (O) to represent the molecules in each phase. Indicate the name of the phase change above the arrow.
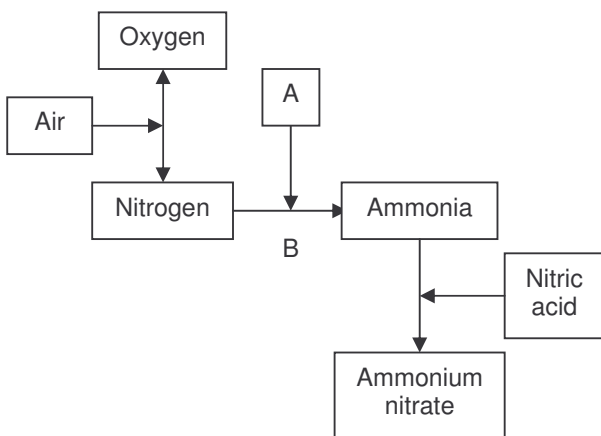

(phase 1)   (phase 2)
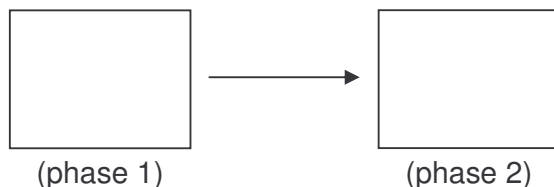
(4)

13.4   Name the heat involved in the phase change mentioned in QUESTION 13.3.   (2)

[11]

QUESTION 14

Nitrogen is one of the most important elements in our world. The flow diagram below shows how nitrogen is used to prepare other nitrogen compounds. Study the diagram and answer the questions that follow:

14.1   Name the gas represented by the letter A.   (2)

14.2   Name the process represented by the letter B.   (2)

14.3   Explain briefly what you understand by the term *nitrogen fixation*.   (2)

14.4   What is the importance of the industrial fixation of nitrogen for humans and animals?   (3)

14.5   Ammonium nitrate is a water-soluble fertilizer. A small farming community lives very close to a river, which is their only source of water. Excessive use of this fertilizer over a long period of time may have a harmful effect on this community. Explain how this practice may affect the community.   (4)

[13]

QUESTION 15

A learner collects rainwater every 15 minutes on a rainy day in separate containers. The learner determines the pH of the rainwater and records the results in the table below.

Container	1	2	3	4	5
pH of rainwater	5,2	5,4	5,3	5,6	5,9
Time of collection (minutes)	0	15	30	45	60

15.1   What does the learner conclude about the acidity of the rainwater from the table? (2)

15.2   Write down a possible reason why the pH of the rainwater increases with time. (2)

15.3   What could be the possible reasons for the low pH of rainwater in this area? (4)

15.4   What effect will this type of environment have on each of the following:

      15.4.1   Human beings
      15.4.2   Aquatic life
      15.4.3   Buildings (6)

[14]

TOTAL SECTION B: 115

GRAND TOTAL: 150

NSC
THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKE TABEL VAN ELEMENTE

KEY / *SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29
1,9 Cu
63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 / 2,1 H / 1																	2 He 4
3 / 1,0 Li / 7	4 / 1,5 Be / 9											5 / 2,0 B / 11	6 / 2,5 C / 12	7 / 3,0 N / 14	8 / 3,5 O / 16	9 / 4,0 F / 19	10 Ne 20
11 / 0,9 Na / 23	12 / 1,2 Mg / 24											13 / 1,5 Aℓ / 27	14 / 1,8 Si / 28	15 / 2,1 P / 31	16 / 2,5 S / 32	17 / 3,0 Cℓ / 35,5	18 Ar 40
19 / 0,8 K / 39	20 / 1,0 Ca / 40	21 / 1,3 Sc / 45	22 / 1,5 Ti / 48	23 / 1,6 V / 51	24 / 1,6 Cr / 52	25 / 1,5 Mn / 55	26 / 1,8 Fe / 56	27 / 1,8 Co / 59	28 / 1,8 Ni / 59	29 / 1,9 Cu / 63,5	30 / 1,6 Zn / 65	31 / 1,6 Ga / 70	32 / 1,8 Ge / 73	33 / 2,0 As / 75	34 / 2,4 Se / 79	35 / 2,8 Br / 80	36 Kr 84
37 / 0,8 Rb / 86	38 / 1,0 Sr / 88	39 / 1,2 Y / 89	40 / 1,4 Zr / 91	41 Nb / 92	42 / 1,8 Mo / 96	43 / 1,9 Tc	44 / 2,2 Ru / 101	45 / 2,2 Rh / 103	46 / 2,2 Pd / 106	47 / 1,9 Ag / 108	48 / 1,7 Cd / 112	49 / 1,7 In / 115	50 / 1,8 Sn / 119	51 / 1,9 Sb / 122	52 / 2,1 Te / 128	53 / 2,5 I / 127	54 Xe 131
55 / 0,7 Cs / 133	56 / 0,9 Ba / 137	57 La / 139	72 / 1,6 Hf / 179	73 Ta / 181	74 W / 184	75 Re / 186	76 Os / 190	77 Ir / 192	78 Pt / 195	79 Au / 197	80 Hg / 201	81 / 1,8 Tℓ / 204	82 / 1,8 Pb / 207	83 / 1,9 Bi / 209	84 / 2,0 Po	85 / 2,5 At	86 Rn
87 / 0,7 Fr	88 / 0,9 Ra / 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

EXAMINATION NUMBER: _____ **NAME:** _____

PHYSICAL SCIENCES GRADE 10 ANSWER SHEET
FISIESE WETENSKAPPE GRAAD 10 ANTWOORDBLAD

QUESTION 1 / *VRAAG 1*   **QUESTION 2 /** *VRAAG 2*

1.1 _____ (1)   2.1 _____ (1)

1.2 _____ (1)   2.2 _____ (1)

1.3 _____ (1)   2.3 _____ (1)

1.4 _____ (1)   2.4 _____ (1)

1.5 _____ (1)   2.5 _____ (1)
                                [5]   **[5]**

QUESTION 3 / *VRAAG 3*

3.1 _____

_____ (2)

3.2 _____

_____ (2)

3.3 _____

_____ (2)

3.4 _____

_____ (2)

3.5 _____

(2)
[10]

QUESTION 4 / *VRAAG 4*

4.1	A	B	C	D
4.2	A	B	C	D
4.3	A	B	C	D
4.4	A	B	C	D
4.5	A	B	C	D

(5 x 3)   15
TOTAL SECTION A / TOTAAL AFDELING A: 35