basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES: CHEMISTRY (P2)

NOVEMBER 2016

NATIONAL SENIOR CERTIFICATE

GRADE 11

MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages, 4 data sheets and 1 answer sheet.

INSTRUCTIONS AND INFORMATION

1. Write your name and class (for example 11A) in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 10 questions. Answer ALL the questions in the ANSWER BOOK except QUESTIONS 4.1.2, 4.1.3 and 4.1.6, which have to be answered on the attached ANSWER SHEET. The ANSWER SHEET has to be handed in together with the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions et cetera where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK, for example 1.11 E.

1.1 The type of bond formed between a H^+ ion and H_2O is called a/an ...

A hydrogen bond.

B dative covalent bond.

C ionic bond.

D covalent bond. (2)

1.2 The shape of the molecule in which the central atom is surrounded by two lone pairs and two bonding pairs is ...

A linear.

B trigonal planar.

C tetrahedral.

D bent. (2)

1.3 The intermolecular forces in dry ice (CO_2) are ...

A ion-induced dipole forces.

B hydrogen bonding.

C ion-dipole forces.

D London forces. (2)

1.4 The bond energy of a C–Cℓ bond is 338 $kJ.mol^{-1}$ whereas the bond energy of a C–I bond is 238 $kJ.mol^{-1}$. The difference in bond energy exists because ...

A the bond length of the C–Cℓ bond is greater than that of the C–I bond.

B chlorine is more electronegative than iodine.

C the bond length of the C–I bond is greater than that of the C–Cℓ bond.

D the chlorine atom is bigger than the iodine atom. (2)

1.5 A gas of volume V is at a temperature T_1 and pressure P_1 in a gas syringe. If the pressure on the gas is doubled and the temperature halved, then the volume that the gas will occupy is ...

A ¼ V

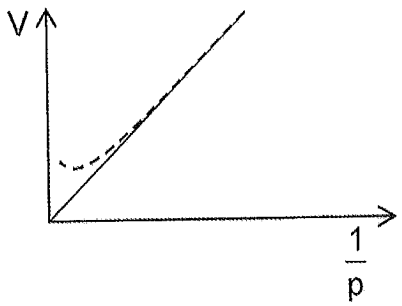
B ½ V

C V

D 2 V (2)

1.6 Which ONE of the graphs below CORRECTLY represents the deviation of a real gas from ideal gas behaviour at very high pressures? The dotted line represents the graph of the real gas.

A



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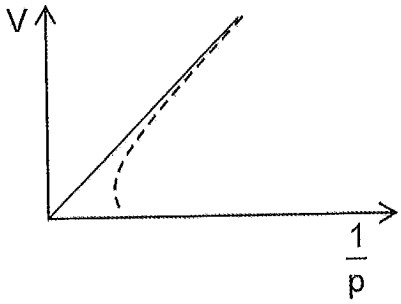

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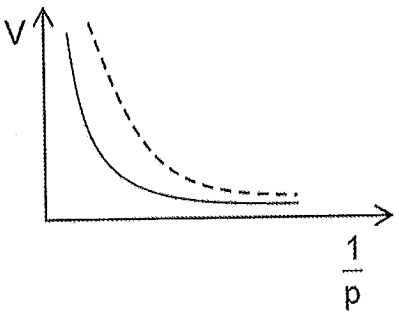
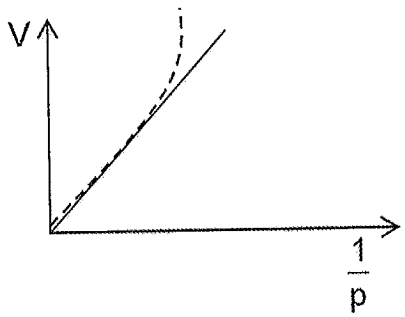


D



(2)

1.7 The flowers of hydrangeas are natural indicators of soil pH. A natural indicator is made in a laboratory by using hydrangea flowers. NaOH and HCℓ are added to the indicator and the colour change is recorded in the table below.

INDICATOR	NATURAL COLOUR	NaOH	HCℓ
Hydrangea flowers	Blue	Purple	Pink

If orange juice is added to the indicator above, the observed colour may be ...

A brown.

B pink.

C purple.

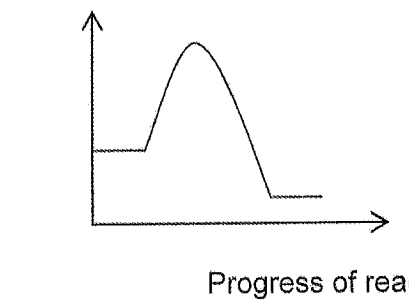
D blue. (2)

1.8 Cellular respiration occurs inside the cells of all living organisms. Oxygen reacts with glucose in cellular respiration to produce the following compounds according to the balanced equation below:

$$C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(\ell) \quad \Delta H = -2\,830 \text{ kJ}$$

The potential energy versus progress of reaction diagram for this reaction is ...

A



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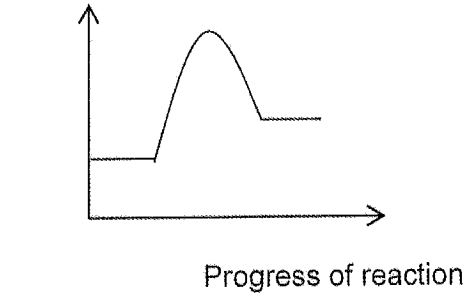
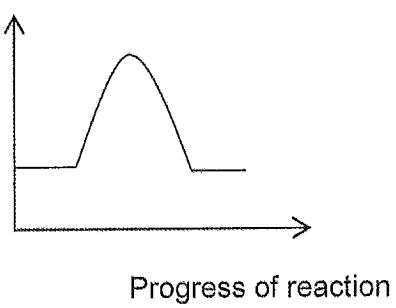


C



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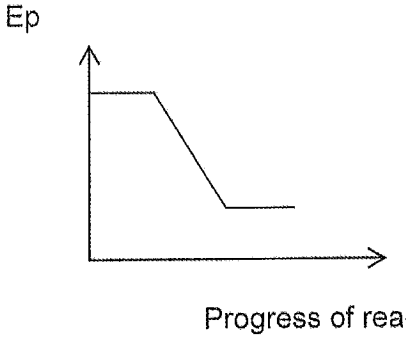


(2)

1.9 The oxidation number of phosphorus in H_3PO_4 is …

A +3

B -2

C +2

D +5 (2)

1.10 During the processing of gold ore, zinc is added to the gold cyanide solution to produce gold according to the balanced equation below:

$$Zn(s) + 2NaAu(CN)_2(aq) \rightarrow 2Au(s) + Zn(CN)_2(aq) + 2NaCN(aq)$$

The reducing agent in this reaction is …

A Na^+

B Au^+

C Zn

D CN^- (2)
[20]

QUESTION 2 (Start on a new page.)

Electronegativity of atoms may be used to explain the polarity of bonds.

2.1 Define the term *electronegativity.* (2)

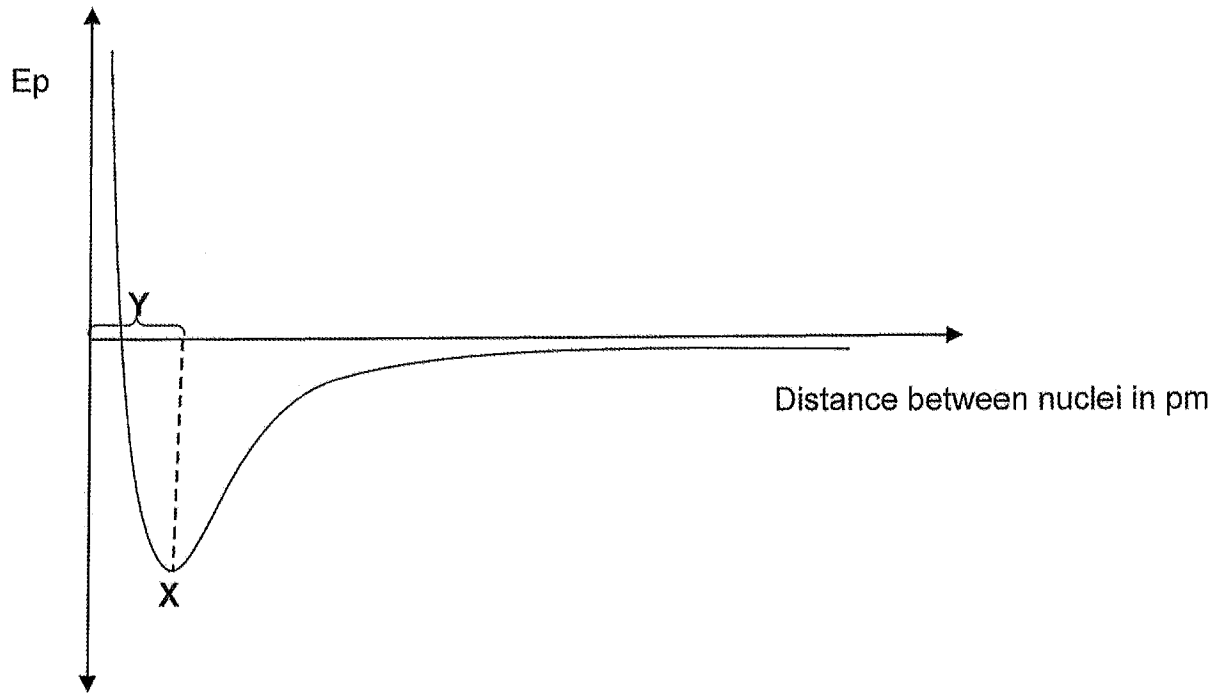
2.2 Draw the Lewis diagram of an oxygen difluoride molecule. (2)

2.3 Calculate the electronegativity difference between O and F in oxygen difluoride and predict the polarity of the bond. (2)

2.4 A polar bond does not always lead to a polar molecule.

Explain the statement by referring to OF_2 and CO_2 molecules. In your explanation, include the polarity of the bonds and the shape of the molecules. (4)

2.5 The diagram below shows the energy change that takes place when two atoms move towards each other.



2.5.1 What does **X** and **Y** represent? (2)

2.5.2 Define the concept represented by **X**. (2)

2.5.3 Explain the relationship between bond order, bond length and bond energy. (3)
[17]

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

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)
2,1 **H** 1																	2 **He** 4
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	10 **Ne** 20
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	18 **Ar** 40
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	36 **Kr** 84
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	54 **Xe** 131
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**	86 **Rn**
0,7 **Fr**	0,9 **Ra** 226	**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**

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29 Cu 63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

TABLE 4A: STANDARD REDUCTION POTENTIALS
TABEL 4A: STANDAARD-REDUKSIEPOTENSIALE

Half-reactions/*Halfreaksies*	E^{θ} (V)
$F_2(g) + 2e^- \rightleftharpoons 2F^-$	+ 2,87
$Co^{3+} + e^- \rightleftharpoons Co^{2+}$	+ 1,81
$H_2O_2 + 2H^+ + 2e^- \rightleftharpoons 2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$	+ 1,51
$C\ell_2(g) + 2e^- \rightleftharpoons 2C\ell^-$	+ 1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O$	+ 1,33
$O_2(g) + 4H^+ + 4e^- \rightleftharpoons 2H_2O$	+ 1,23
$MnO_2 + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O$	+ 1,23
$Pt^{2+} + 2e^- \rightleftharpoons Pt$	+ 1,20
$Br_2(\ell) + 2e^- \rightleftharpoons 2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^- \rightleftharpoons Hg(\ell)$	+ 0,85
$Ag^+ + e^- \rightleftharpoons Ag$	+ 0,80
$NO_3^- + 2H^+ + e^- \rightleftharpoons NO_2(g) + H_2O$	+ 0,80
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	+ 0,77
$O_2(g) + 2H^+ + 2e^- \rightleftharpoons H_2O_2$	+ 0,68
$I_2 + 2e^- \rightleftharpoons 2I^-$	+ 0,54
$Cu^+ + e^- \rightleftharpoons Cu$	+ 0,52
$SO_2 + 4H^+ + 4e^- \rightleftharpoons S + 2H_2O$	+ 0,45
$2H_2O + O_2 + 4e^- \rightleftharpoons 4OH^-$	+ 0,40
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+ 0,34
$SO_4^{2-} + 4H^+ + 2e^- \rightleftharpoons SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	+ 0,16
$Sn^{4+} + 2e^- \rightleftharpoons Sn^{2+}$	+ 0,15
$S + 2H^+ + 2e^- \rightleftharpoons H_2S(g)$	+ 0,14
$2H^+ + 2e^- \rightleftharpoons H_2(g)$	**0,00**
$Fe^{3+} + 3e^- \rightleftharpoons Fe$	– 0,06
$Pb^{2+} + 2e^- \rightleftharpoons Pb$	– 0,13
$Sn^{2+} + 2e^- \rightleftharpoons Sn$	– 0,14
$Ni^{2+} + 2e^- \rightleftharpoons Ni$	– 0,27
$Co^{2+} + 2e^- \rightleftharpoons Co$	– 0,28
$Cd^{2+} + 2e^- \rightleftharpoons Cd$	– 0,40
$Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$	– 0,41
$Fe^{2+} + 2e^- \rightleftharpoons Fe$	– 0,44
$Cr^{3+} + 3e^- \rightleftharpoons Cr$	– 0,74
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	– 0,76
$2H_2O + 2e^- \rightleftharpoons H_2(g) + 2OH^-$	– 0,83
$Cr^{2+} + 2e^- \rightleftharpoons Cr$	– 0,91
$Mn^{2+} + 2e^- \rightleftharpoons Mn$	– 1,18
$A\ell^{3+} + 3e^- \rightleftharpoons A\ell$	– 1,66
$Mg^{2+} + 2e^- \rightleftharpoons Mg$	– 2,36
$Na^+ + e^- \rightleftharpoons Na$	– 2,71
$Ca^{2+} + 2e^- \rightleftharpoons Ca$	– 2,87
$Sr^{2+} + 2e^- \rightleftharpoons Sr$	– 2,89
$Ba^{2+} + 2e^- \rightleftharpoons Ba$	– 2,90
$Cs^+ + e^- \rightleftharpoons Cs$	- 2,92
$K^+ + e^- \rightleftharpoons K$	– 2,93
$Li^+ + e^- \rightleftharpoons Li$	– 3,05

Increasing oxidising ability/*Toenemende oksiderende vermoë* ↑

Increasing reducing ability/*Toenemende reduserende vermoë* ↓

TABLE 4B: STANDARD REDUCTION POTENTIALS
TABEL 4B: STANDAARD-REDUKSIEPOTENSIALE

Half-reactions/*Halfreaksies*	E^{θ} (V)
$Li^+ + e^- \rightleftharpoons Li$	– 3,05
$K^+ + e^- \rightleftharpoons K$	– 2,93
$Cs^+ + e^- \rightleftharpoons Cs$	– 2,92
$Ba^{2+} + 2e^- \rightleftharpoons Ba$	– 2,90
$Sr^{2+} + 2e^- \rightleftharpoons Sr$	– 2,89
$Ca^{2+} + 2e^- \rightleftharpoons Ca$	– 2,87
$Na^+ + e^- \rightleftharpoons Na$	– 2,71
$Mg^{2+} + 2e^- \rightleftharpoons Mg$	– 2,36
$A\ell^{3+} + 3e^- \rightleftharpoons A\ell$	– 1,66
$Mn^{2+} + 2e^- \rightleftharpoons Mn$	– 1,18
$Cr^{2+} + 2e^- \rightleftharpoons Cr$	– 0,91
$2H_2O + 2e^- \rightleftharpoons H_2(g) + 2OH^-$	– 0,83
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	– 0,76
$Cr^{3+} + 3e^- \rightleftharpoons Cr$	– 0,74
$Fe^{2+} + 2e^- \rightleftharpoons Fe$	– 0,44
$Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$	– 0,41
$Cd^{2+} + 2e^- \rightleftharpoons Cd$	– 0,40
$Co^{2+} + 2e^- \rightleftharpoons Co$	– 0,28
$Ni^{2+} + 2e^- \rightleftharpoons Ni$	– 0,27
$Sn^{2+} + 2e^- \rightleftharpoons Sn$	– 0,14
$Pb^{2+} + 2e^- \rightleftharpoons Pb$	– 0,13
$Fe^{3+} + 3e^- \rightleftharpoons Fe$	– 0,06
$2H^+ + 2e^- \rightleftharpoons H_2(g)$	**0,00**
$S + 2H^+ + 2e^- \rightleftharpoons H_2S(g)$	+ 0,14
$Sn^{4+} + 2e^- \rightleftharpoons Sn^{2+}$	+ 0,15
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	+ 0,16
$SO_4^{2-} + 4H^+ + 2e^- \rightleftharpoons SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+ 0,34
$2H_2O + O_2 + 4e^- \rightleftharpoons 4OH^-$	+ 0,40
$SO_2 + 4H^+ + 4e^- \rightleftharpoons S + 2H_2O$	+ 0,45
$Cu^+ + e^- \rightleftharpoons Cu$	+ 0,52
$I_2 + 2e^- \rightleftharpoons 2I^-$	+ 0,54
$O_2(g) + 2H^+ + 2e^- \rightleftharpoons H_2O_2$	+ 0,68
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	+ 0,77
$NO_3^- + 2H^+ + e^- \rightleftharpoons NO_2(g) + H_2O$	+ 0,80
$Ag^+ + e^- \rightleftharpoons Ag$	+ 0,80
$Hg^{2+} + 2e^- \rightleftharpoons Hg(\ell)$	+ 0,85
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO(g) + 2H_2O$	+ 0,96
$Br_2(\ell) + 2e^- \rightleftharpoons 2Br^-$	+ 1,07
$Pt^{2+} + 2e^- \rightleftharpoons Pt$	+ 1,20
$MnO_2 + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O$	+ 1,23
$O_2(g) + 4H^+ + 4e^- \rightleftharpoons 2H_2O$	+ 1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O$	+ 1,33
$C\ell_2(g) + 2e^- \rightleftharpoons 2C\ell^-$	+ 1,36
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$	+ 1,51
$H_2O_2 + 2H^+ + 2e^- \rightleftharpoons 2H_2O$	+1,77
$Co^{3+} + e^- \rightleftharpoons Co^{2+}$	+ 1,81
$F_2(g) + 2e^- \rightleftharpoons 2F^-$	+ 2,87

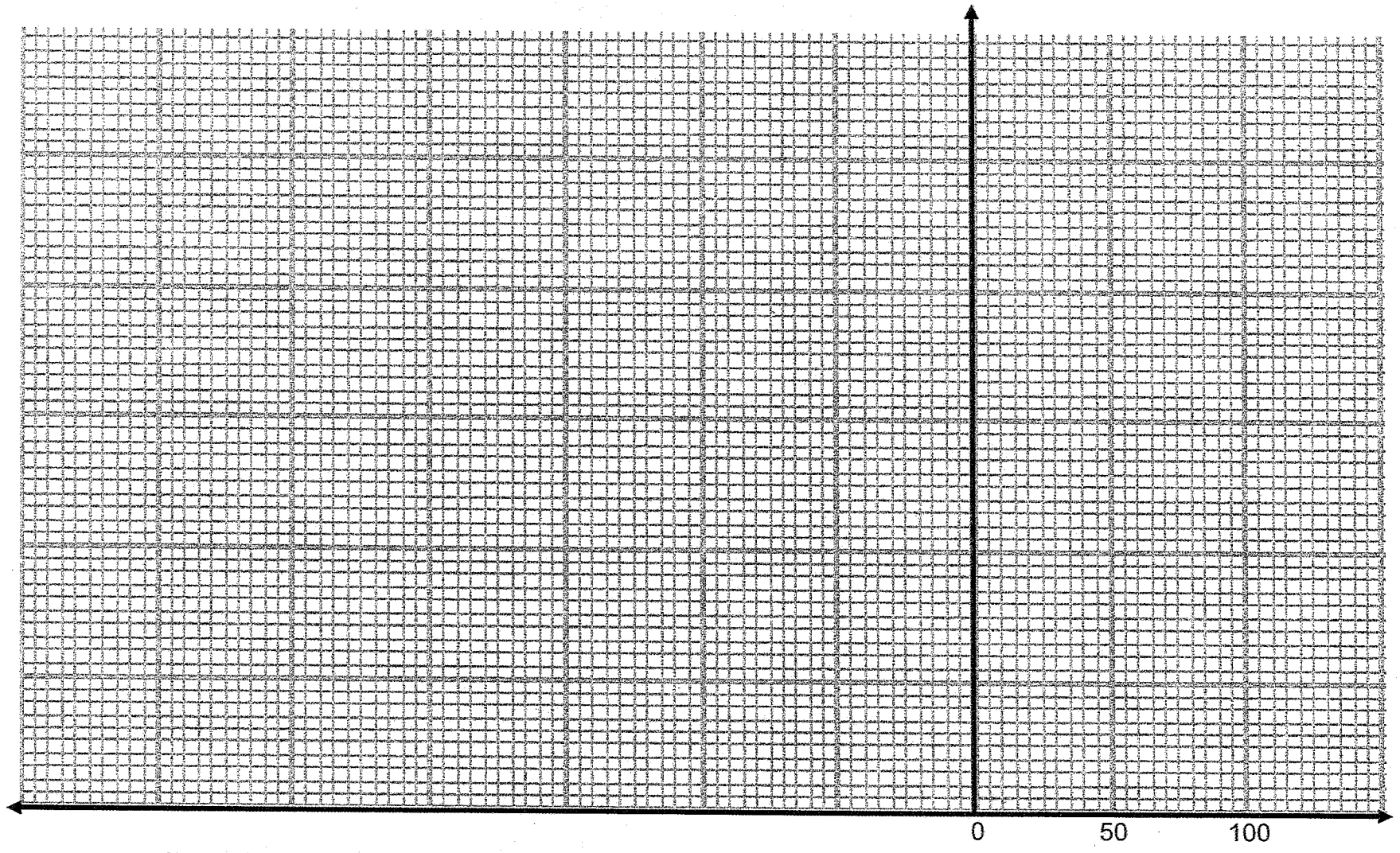
Increasing oxidising ability/Toenemende oksiderende vermoë ↓

Increasing reducing ability/Toenemende reduserende vermoë ↑

NAME:		CLASS:	

QUESTIONS 4.1.2, 4.1.3 and 4.1.6

Hand in this ANSWER SHEET together with the ANSWER BOOK.



QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 D ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C / B ✓✓ (2)

1.5 A ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 A ✓✓ (2)

1.9 D ✓✓ (2)

1.10 C ✓✓ (2)
[20]

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 11

PHYSICAL SCIENCES: CHEMISTRY (P2)/
FISIESE WETENSKAPPE: CHEMIE (V2)

NOVEMBER 2016

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 11 pages.
Hierdie memorandum bestaan uit 11 bladsye.

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2016 -11- 08
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

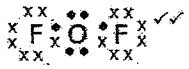
8/11/16

Please turn over/*Blaai om asseblief*

QUESTION 2/*VRAAG 2*

2.1 Electronegativity is a measure of the tendency of an atom in a molecule to attract bonding electrons. ✓✓
Elektronegatiwiteit is 'n maatstaf van die neiging van 'n atoom in 'n molekuul om bindingselektrone aan te trek✓✓ (2)

2.2



Marking Criteria/*Nasienkriteria*
- All atoms shown with 8 electrons around it.
  Alle atome met 8 elektrone rondom elk geteken
- Two electron pairs on O atoms shared with two F atoms as shown.
  Twee elektronpare op O-atome gedeel met twee F-atome, soos getoon

NOTE: Accept bent/angular Lewis structure
***NOTA:** Aanvaar hoekige struktuur* (2)

2.3 ΔEN (O – F) = 4 – 3,5 = 0,5✓
0 < ΔEN < 1, the bond is weakly polar/*die binding is swak polêr*✓ (2)

2.4
- The bonds in both molecules are polar✓ due to the difference in electronegativity between O and F and C and O.
- The shape of the OF_2 molecule is angular/bent✓ and because the charge distribution is asymmetrical✓ around the central atom the molecule is polar.
- The shape of the CO_2 molecule is linear✓ and because the charge distribution is symmetrical around the central atom the molecule is non-polar.

Die bindings in albei molekules is polêr✓ as gevolg van die verskil in elektronegatiwiteit tussen O en F en tussen C en O.
Die vorm van die OF_2-molekule is hoekig ✓en omdat die ladings asimmetries ✓versprei is rondom die sentrale atoom is die molekuul polêr
Die vorm van die CO_2-molekuul is lineêr ✓en omdat die ladings simmetries versprei is rondom die sentrale atoom is die molekuul nie-polêr (4)

Marking Criteria/*Nasienkriteria*
- Both Polar bonds✓ */ Beide het polêre bindings*✓
- Angular/ Bent ✓ */ Hoekig*✓
- Linear ✓ */ Lineêr*✓
- Symmetrical/asymmetrical ✓ / *Simmetries/Asimmetries*✓

2.5.1 X = bond energy ✓
Y = bond length ✓
X = bindingsenergie✓
Y = bindingslengte✓ (2)

2.5.2 The energy needed to break one mole of its molecules into separate atoms.✓✓
Die energie benodig om een mol van sy molekules in aparte atome op te breek.✓✓ (2)

2.5.3 The higher the bond order (number of bonds between atoms),✓ the shorter the bond length✓, the stronger the bond and the bond energy increases✓.

The lower the bond order✓, the longer the bond length✓, the weaker the bond and the bond energy decreases. ✓

Hoe hoër die bindingsorde, ✓ hoe korter is die bindingslengte, ✓ hoe sterker die binding en die bindingsenergie neem toe.✓

Hoe laer die bindingsorde, ✓ hoe langer is die bindingslengte, ✓ hoe swakker die binding en die bindingsenergie neem af.✓ (3)
[17]

QUESTION 3/*VRAAG 3*

3.1 The temperature at which the vapour pressure of a substance equals to the atmospheric pressure.✓✓
Die temperatuur waarteen die dampdruk van 'n stof aan die atmosferiese druk gelyk is.✓✓ (2)

3.2 What is the relationship between intermolecular forces and boiling point?✓✓
Wat is die verband tussen intermolekulêre kragte en kookpunt? ✓✓

How does the strength of the intermolecular force affect the boiling point? ✓✓ (2)
Hoe sal die sterkte van die intermolekulêre kragte die kookpunt beïnvloed? ✓✓

NOTE : Identifying independent and dependent variables – 1 mark/*Aanduì van korrekte veranderlikes – 1 punt*
Formulating a question regarding the relationship between variables – 1 mark
Formuleer van 'n vraag met betrekking tot die veranderlikes – 1 punt

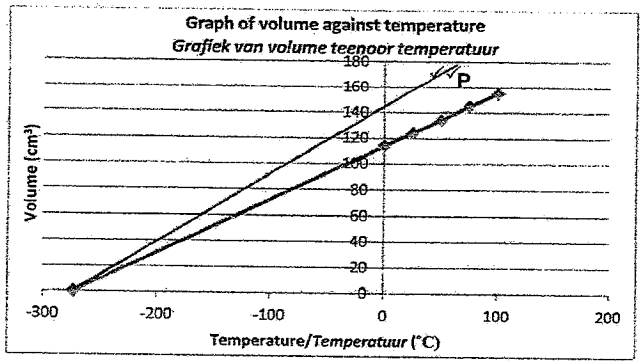
3.3 Glycerine✓It has the highest boiling point.✓
Glisirien ✓ Dit het die hoogste kookpunt.✓ (2)

3.4 No,✓
boiling point is only affected by the atmospheric pressure✓.
Accept
boiling point is not affected by volume of the liquid. ✓
boiling point is affected by the intermolecular forces which in this case did not change. ✓
Nee✓
kookpunt word slegs deur die atmosferiese druk beïnvloed. ✓

Aanvaar:
Kookpunt word nie deur volume beïnvloed nie✓
Kookpunt word deur intermolekulêre kragte beïnvloed wat in die geval nie verander het nie. ✓ (2)

3.5 Avoid direct heating with open flame✓
Work in a well-ventilated room/use a fume cupboard ✓
Accept
Protective clothing, heating in a water bath./
Vermy dit om naby 'n oop vlam te werk✓ (2)

4.1.2, 4.1.3 and/*en* 4.1.6



Marking Criteria for Question 4.1.2 /*Nasienkriteria*
- Labelling both axes with the unit correctly✓
  Benoem beide asse met eenheid korrek✓
- Plotting minimum three points correctly ✓✓
  Stip minimum drie punte korrek✓✓
- Shape of the graph✓
  Vorm van die grafiek✓ *(4)*

x-intercept = -273 °C ✓ (range -270 °C to -273 °C)
x-afsnit = -273 °C ✓ (1)

4.1.4 It is the absolute zero 0 K (-273°C)✓, which is the coldest possible temperature at which the particles will have no kinetic energy/no movement.✓
Dit is die absolute nulpunt 0 K (-273 °C) ✓ *wat die koudste moontlike temperatuur is waarby die deeltjies geen kinetiese energie/ beweging sal hê nie.* ✓ (2)

4.1.5 $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ ✓

$\frac{155}{373} = \frac{V_2}{393}$ ✓

$V_2 = 163{,}31\ cm^3$ ✓

Accept any other set of values from the table.
Using the graph without calculation, correct answer – 1/3 marks
/ Aanvaar enige stel waardes vanuit die tabel. Indien die grafiek gebruik word sonder 'n berekening met 'n korrekte antwoord- 1/3 punte (3)

4.1.6 Straight line above graph (steeper gradient) drawn in QUESTION 4.1.2✓
x-intercept = -273 °C (OR the same x-intercept as drawn in QUESTION 4.1.3)✓
Reguitlyn bo grafiek (groter helling) in VRAAG 4.1.2 geteken ✓
x-afsnit = -273 °C (OF dieselfde x-afsnit soos geteken in VRAAG 4.1.3)✓ (2)

Werk in 'n goed geventileerde vertrek/gebruik 'n dampkas✓

Aanvaar:
Dra beskermende klere, verhit in 'n waterbad

3.6 Nail polish remover✓, lowest boiling point/ weakest intermolecular forces✓

Naellakverwyderaar✓*, laagste kookpunt / swakste intermolekulêre kragte*✓ (2)

3.7 Sunflower oil has a large molecular mass✓✓
Sonneblomolie het 'n groot molekulêre massa✓✓ (2)
[14]

QUESTION 4/*VRAAG 4*

4.1.1
- When the temperature of a gas increases, the average speed/kinetic energy of the particles also increase✓.
- At constant pressure the volume will increase✓.

- *Wanneer die temperatuur van 'n gas toeneem, sal die gemiddelde spoed/ kinetiese energie van die deeltjies ook toeneem.* ✓
- *By 'n konstante druk sal die volume toeneem*✓

OR/*OF*

- When the temperature of a gas decreases, the average speed / kinetic energy of the particles also decrease✓.
- At constant pressure the volume will decrease✓

- *Wanneer die temperatuur van 'n gas afneem, sal die gemiddelde spoed/ kinetiese energie van die deeltjies ook afneem.* ✓
- *By konstante druk sal die volume afneem*✓ (2)

4.2.1 $pV = nRT$✓

$(96 \times 10^3)(0,32 \times 10^{-3})$✓ = $n(8,31)(300)$✓

n = 0,0123225mol (0,012mol)

$n = \frac{m}{M}$

$0,0123225 = \frac{0,77}{M}$✓

M = 62,49 g·mol^{-1} ✓ (64,17 g.mol^{-1}) (5)

Accept/*Aanvaar* 62,49 g.mol^{-1}, 64,17 g.mol^{-1} and/*en* 77 g.mol^{-1}

4.2.2 SO_2 ✓✓ **NOTE** – Do not mark this question because it is not possible to determine the gas with the above molar masses. Total for question 4 is **19 marks**/ *NOTA- Die vraag word nie gemerk nie omrede dit nie moontlik om die gas te identifiseer vir die bostaande molêre massas nie.Die totaal vir vraag 4 is dus* ***19 punte***. **[19]**

QUESTION 5/*VRAAG 5*

5.1 Amount of solute per litre of solution/ per unit volume.✓✓
Hoeveelheid oplosmiddel per liter oplossing/ per eenheïdsvolume oplossing✓✓ (2)

5.2 $c = \frac{m}{MV}$ ✓

$c = \frac{8}{(158)(0,5)}$ ✓

c = 1,01x10^{-1} mol.dm^{-3} ✓ (0,10 mol.dm^{-3})

OR/*OF*

$n = \frac{m}{M}$

$= \frac{8}{158}$✓

= 0,0506mol

$c = \frac{n}{V}$

$= \frac{0,0506}{0,5}$

= 1,01x10^{-1} mol.dm^{-3} ✓ (0,10 mol.dm^{-3}) (3)

NOTE : Award 1 mark for both formulae✓
***NOTA**: Ken 1 punt toe vir beide formules*✓

5.3.1 Empirical formula is the simplest whole number ratio between the elements in a compound.✓✓
Empiriese formule is die eenvoudigste heelgetalverhouding tussen die elemente in 'n verbinding✓✓ (2)

5.3.2

Element	$\frac{g}{10g}$	$n = \frac{m}{M}$	Simplest ratio/ *Eenvoudigste verhouding*		
K	2,66	2,66/39 = 0,068✓	1	x2	=2
Cr	3,54	3,54/52 = 0,068✓	1	x2	=2
O	3,81	3,81/16 = 0,238✓	3,5	x2	=7
			✓	✓	✓

Empirical formula/*Empiriese formule*= $K_2Cr_2O_7$✓ (7)
[14]

QUESTION 6/*VRAAG 6*

6.1 Limiting reagent in a reaction is the reactant that is consumed completely. It determines the maximum amount of product that is made.✓✓
Beperkte reagens in 'n reaksie is die reagens wat volledig opgebruik word. Dit bepaal die maksimum hoeveelheid produk wat gemaak word. ✓✓ (2)

6.2

$c = \frac{n}{V}$ ✓

$0,2 = \frac{n}{0,1}$

$n(CH_3COOH)$ = (0,2)(0,1)
= 0,02 mol ✓

$n(NaHCO_3) = \frac{m}{M}$

$n = \frac{10}{84}$ ✓
= 0, 12 mol✓
Mole ratio/*Molverhouding* 1 : 1
0,02 mol CH_3COOH reacts with/*reageer met* 0,02 mol $NaHCO_3$✓
CH_3COOH is the limiting reagent./*is die beperkte reagens* ✓ (6)

6.3 Mass of $NaHCO_3$ in excess:/*Massa $NaHCO_3$ in oormaat*:

$n = \frac{m}{M}$ ✓

$(0,12 - 0,02) = \frac{m}{84}$ ✓

m = 8,4 g ✓ (3)

6.4 **OPTION 1**

0,02 mol $CH_3COOH \rightarrow$ 0,02 mol CO_2✓

$n = \frac{V}{Vm}$ ✓

$0,02 = \frac{V}{22,4}$ ✓

V = (0,02)(22,4)✓
= 0,45 dm^3✓

OPTION 2

60g $CH_3COOH \rightarrow$ 44g CO_2
1,2 g $CH_3COOH \rightarrow$ x

x = 0,88g

$n = \frac{0,88}{44}$ = 0,02mol

V (CO_2) = 0,02 x 22,4 = 0,45dm^3

OPTION 3

Mass of $NaHCO_3$ reacted = 0,02 x 84
= 1,68g

84g → 22.4dm^3
1.68g →x

V= 0.45dm^3

(4)

QUESTION 7/*VRAAG 7*

7.1 Exothermic✓, energy is given out.✓
Eksotermies✓, energie word afgegee. ✓ (2)

7.2 Energy is needed to break the bond between atoms/ions in molecules.✓✓
Energie is nodig om die bindings tussen atome/ione te breek✓✓ (2)
Accept – minimum energy needed to start the reaction.
***Aanvaar**- minimum energie nodig om die reaksie te begin.*

7.3 Produces a greenhouse gas✓ and which can contribute to global warming.✓/ any reference to acid rain - mark correct.
Vervaardig 'n kweekhuisgas✓ wat tot aardverwarming kan bydra✓/ enige verwysing na suurreën word as korrek aanvaar. (2)
[6]

QUESTION 8/*VRAAG 8*

8.1 Acid is a proton donor ✓✓
Suur is 'n protonskenker✓✓ (2)

8.2.1 conjugate pairs/*gekonjugeerde pare*

$H_2PO_4^-$ + NH_3 → HPO_4^{2-} + NH_4^+
a_1 ✓ b_1 ✓ b_1✓ a_2✓

Acid-Base pair/ *Suur-basis pare*
$H_2PO_4^-$/ HPO_4^{2-} and/*en* NH_4^+/ NH_3 (4)

8.2.2 A substance which can act as an acid or a base.✓
'n Stof wat as 'n suur of 'n basis kan optree✓ (1)

8.2.3 $H_2PO_4^-$ OR/OF HPO_4^{2-} ✓✓ (2)

8.3.1 $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$ balancing/*balansering* ✓ (1)

8.3.2 $c = \frac{n}{V}$ ✓

$0,2 = \frac{n}{0,1}$

n = (0,2)(0,1) ✓
= 0,02mol ✓ (3)

8.3.3 n $Mg(OH)_2$ = (0,02)(0,1) ✓
= 0,002mol

n HCl(excess/*oormaat*) = 2✓(0,002) = 0,004mol

n HCl react with/*reageer met* Na_2CO_3 = 0,02 $\overset{\checkmark}{-}$ 0,004 = 0,016mol

n Na_2CO_3 = 0,008mol (dividing answer by 2/*deel antwoord deur 2*) ✓

m Na_2CO_3 = nM = (0,008)(106) ✓
= 0,848 g✓

$\%\,purity / suiwerheid = \frac{0,848}{10} \times 100$ ✓ = 8,48%✓ (8)

[21]

QUESTION 9/*VRAAG 9*

9.1 Oxidation is the increase in oxidation numbers ✓✓
Oksidasie is die toename in oksidasiegetalle ✓✓ (2)

9.2.1 Cu(s) ✓✓ (2)

9.2.2 Silver ion/*Silwerioon OR* $AgNO_3$✓✓ (2)

9.2.3 $Cu \rightarrow Cu^{2+} + 2e^-$ ✓✓ (2)

Marking Criteria/*Nasienkriteria*
$Cu \rightarrow Cu^{2+} + 2e^-$ 1/2 marks/*punte*

9.2.4 $Cu \rightarrow Cu^{2+} + 2e^-$
$Ag^+ + e^- \rightarrow Ag$ ✓
$Cu + 2Ag^+$✓ $\rightarrow Cu^{2+} + 2Ag$✓ balancing/*balansering* ✓ (4)

9.3 $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$
+1 0
Ag oxidation number changes/decreases from +1 to 0, gaining electrons, reduction. ✓✓
Ag se oksidasiegetal verander van +1 na 0, ontvang elektrone, reduksie✓✓ (2)
[14]

QUESTION 10/*VRAAG 10*

10.1 Open cast mining/*Oopgroefmyn* ✓
Underground (Deep pit) mining/*Ondergrondse myn* ✓ (2)

10.2 Create job opportunities✓/Local communities benefit from infrastructure ✓/
Provides opportunities for other industries
Skep werksgeleenthede✓*/Plaaslike gemeenskappe verkry voordeel ten opsigte van infrastrukture*✓*/Verskaf geleenthede aan ander nywerhede* (2)

10.3
Changing landscape Air pollution Resource consumption Water poisoning	✓✓ any two
Veranderende landskap *Lugbesoedeling* *Hulpbronverbruik* *Watervergiftiging*	✓✓ *enige twee*

(2)

10.4.1 It is too soft ✓
Dit is te sag ✓ (1)

10.4.2 Used in computer circuits ✓/Used as a heat protector in space suits/any other relevant answer
Gebruik in rekenaarstroombane/Gebruik as 'n hittebeskermer in ruimtepakke/ enige ander relevante antwoord✓ (1)
[8]

TOTAL/*TOTAAL*: 150

Annexure A: English and Afrikaans versions. Marks converted from 148 to 150

Mark out of 148	Converted to 150
1	1
2	2
3	3
4	4
5	5
6	6
7	7
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45	46

Mark out of 148	Converted to 150
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Mark out of 148	Converted to 150
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135	137

Mark out of 148	Converted to 150
136	138
137	139
138	140
139	141
140	142
141	143
142	144
143	145
144	146
145	147
146	148
147	149
148	150

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TO: HEADS OF EXAMINATION SECTIONS
HEADS OF CURRICULUM SECTIONS

EXAMINATION INSTRUCTION NO 33 OF 2016

AMENDMENTS TO THE MARKING GUIDELINE OF THE 2016 COMMON EXAMINATION FOR GRADE 11: PHYSICAL SCIENCES P2

In Question 4.2.2 in the Grade 11 Physical Sciences P2 National Examination, the instruction to learners was not clear.

1. The instruction related to the rounding off in question 4.2.2 was not given clearly to learners. This prevented them from calculating the molar masses accurately.
2. This question which carries 2 marks must be excluded from the marking.
3. As a result the total for Question 4 will be reduced from 21 marks to 19 marks.
4. Consequently the total marks for the question paper must be reduced to 148 marks, then scaled up to 150 marks.
5. Refer to **Annexure A** that provides the conversion table that must be used to calculate the learners' final marks.
6. For further information please contact the Director: Examinations and Assessment, Ms P Ogunbanjo at 012 357 3909 or email: Ogunbanjo.p@dbe.gov.za

DR RR POLIAH
CHIEF DIRECTOR: NATIONAL ASSESSMENT AND PUBLIC EXAMINATIOS
DATE: 8-11-16