education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT
PROVINSIALE ASSESSERING

GRADE/*GRAAD* 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

FISIESE WETENSKAPPE: CHEMIE (V2)

JUNE/*JUNIE* 2024

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 13 pages including the cognitive table.
Hierdie nasienriglyne bestaan uit 13 bladsye insluitend die kognitiewe tabel.

QUESTION 1/*VRAAG 1*

1.1.	C	✓✓	(2)
1.2	B	✓✓	(2)
1.3	D	✓✓	(2)
1.4	C	✓✓	(2)
1.5	D	✓✓	(2)
1.6	D	✓✓	(2)
1.7	D	✓✓	(2)
1.8	D	✓✓	(2)
1.9	B	✓✓	(2)
1.10	A	✓✓	(2)

[20]

QUESTION 2/*VRAAG 2*

2.1.1 A and/*en* B ✓ (1)

2.1.2 D ✓ (1)

2.1.3 F ✓ (1)

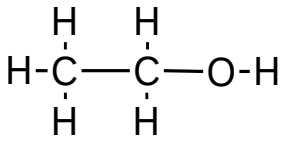
2.2.1 Compound that contains carbon and hydrogen atoms only. ✓ ✓
Verbinding wat net uit koolstof en waterstof atome bestaan. **(2 or 0)** (2)

2.2.2 UNSATURATED ✓ Contains double bond ✓ ✓ /multiple bonds (between the C-atoms in the hydrocarbon chain).
ONVERSADIG Bevat 'n dubbelbinding/meervoudige bindings (tusen C-atome in die koolwaterstof ketting) (3)

2.2.3 2-methylbut-2-ene ✓✓
2-metielbut-2-een (2)

2.3 haloalkanes /alkyl halide/haloalkene✓✓
halo alkaan/alkiel halied/halo alkeen (2)

2.4.1 Ethyl methanoate ✓✓
etielmetanoaat (2)

2.4.2  ✓✓ (2)

2.4.3 Methanoic acid ✓
metanoësuur (2)

2.5.1 (Compounds with) the same molecular formula ✓ but different functional groups / different homologous series. ✓
(Verbindings met) dieselfde molekulêre formule maar verskillende funksionele groepe/ verskillende homoloë reeks. (2)

2.5.2 F and/*en* I ✓✓ (2)
[22]

QUESTION 3/*VRAAG 3*

3.1 The pressure exerted by a vapour at equilibrium with its liquid in a closed system. ✓✓
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem (2)

3.2 3.2.1 Functional group/homologous series ✓
Funksionele groep/homoloë reeks (1)

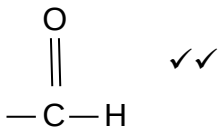
3.2.2 Boiling point/*Kookpunt* ✓ (1)

3.3 Higher than.✓ The van der Waals forces increases✓ with increasing molecular mass✓ or the longer the carbon chain/greater the surface, the greater the intermolecular forces will become.

Groter as. Die Van der Waals-kragte neem toe met toenemende molekulêre massa, of hoe langer die koolstofketting/groter die oppervlak, hoe groter sal die intermolekulêre kragte word. (3)

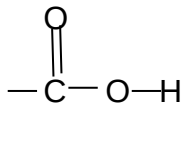
3.4

3.4.1



✓✓ (2)

3.4.2



✓✓ (2)

3.5 Higher than/*Hoër as* ✓

- Butanal (A) has dipole-dipole intermolecular forces whilst Butan-1-ol (B) has Hydrogen bond. ✓
  Butanaal (A) het dipool-dipool intermolekulêre kragte terwyl Butan-1-ol (B) Waterstofbindings het.

- The strength of intermolecular forces in Butanal (A) is <u>weaker</u> than in Butan-1-ol (B) ✓
  Die sterkte van intermolekulêre kragte in Butanaal (A) is <u>swakker</u> as in Butan-1-ol (B)

- Less energy is needed to overcome the intermolecular forces in Butanal (A) than in Butan-1-ol (B). ✓
  Minder energie is nodig om die intermolekulêre kragte in Butanaal (A) te oorkom as in Butan-1-ol (B)

OR/*OF*

- Butan-1-ol (B) has Hydrogen bond whilst Butanal (A) has dipole-dipole intermolecular forces.
  Butan-1-ol (B) het waterstofbinding terwyl Butanaal (A) dipool-dipool intermolekulêre kragte het.

- The strength of intermolecular forces in Butan-1-ol (B) is <u>stonger</u> than in *Butanal* (A).
  Die intermolekulêre kragte in Butan-1-ol (B) is <u>sterker</u> as Butanaal (A).

- More energy is needed to overcome the intermolecular forces in Butan-1-ol (B) than in Butanal (A)
  Meer energie is nodig om die intermolekulêre kragte in Butan-1-ol (B) te oorkom as in Butanaal (A). (4)

[15]

QUESTION 4/*VRAAG 4*

4.1

4.1.1 Substitution (Halogenation/Bromination) ✓
Substitusie (Halogenering/Bromering) (1)

4.1.2 Addition(Hydration) ✓
Addisie(Hidrasie) (1)

4.1.3 Elimination(Cracking) ✓
Eliminasie (Kraking) (1)

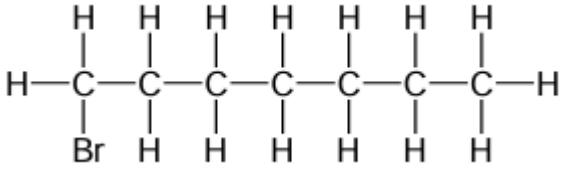
4.2 Heptan-2-ol/2-Heptanol ✓✓ (2)

4.3

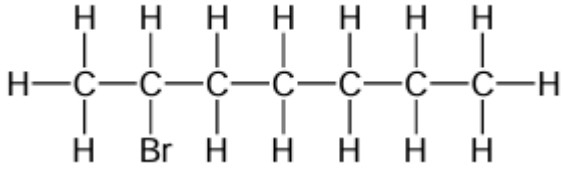
4.3.1 C_7H_{16} ✓✓ (2)

4.3.2 C_3H_6 ✓✓ (2)

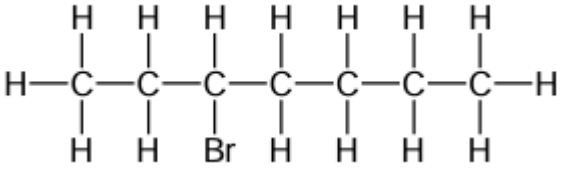
4.4 Any one of the following/*Enige een van die volgende*:



OR/*OF*



OR/OF ✓✓



(2)

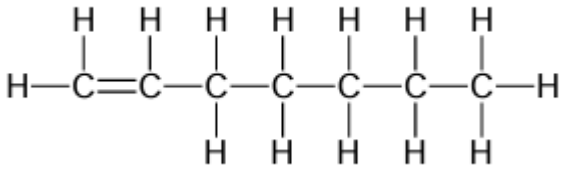
4.5 **2**C_4H_{10} + $13O_2$ → **8**CO_2 + **10**H_2O (3)

Notes/*Nota's:*
- Reactants /*Reaktante*✓
- Products/*Produkte* ✓
- Balancing/*Balansering* ✓
- Ignore/*ignoreer* ⇌ and phases/*en fases*

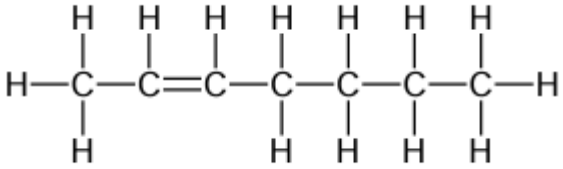
Marking rule/*Nasienreël* 6.3.10

4.6

4.6.1



✓✓ **OR/*OF***



(2)

4.6.2 Concentrated strong base(KOH)/*Gekonsentreerde sterk basis (KOH)* ✓
Strong heat/Sterk verhit ✓ (2)

[18]

QUESTION 5/*VRAAG 5*

5.1.1 **ANY ONE*:***

- Change in concentration ✓of products/reactants per unit time.✓
- Change in amount/number of mole/volume/mass ✓of products/reactants per unit time.✓
- Amount/number of mole/volume/mass of products formed/reactants used✓ per unit time.✓
- Rate of change in concentration/amount of moles/number of moles/volume/mass.✓✓(**2 or 0**)

ENIGE EEN:

- *Verandering in konsentrasie van produkte/reaktanse per eenheid tyd.*
- *Verandering in hoeveelheid/getal mol/volume/massa van produkte/reaktanse per eenheid tyd.*
- *Hoeveelheid/getal mol/volume/massa van produkte gevorm/reaktanse gebruik per eenheid tyd.*
- *Tempo van verandering in konsentrasie/hoeveelheid/getal mol//volume/massa* (**2 of 0**)

NOTE
Give the mark for per unit time only if in correct context of reaction rate
NOTA
Gee die punt vir per eenheid tyd slegs indien dit in die korrekte konteks vir reaksietempo gebruik is (2)

5.1.2 Experiment 1/*Eksperiment 1* ✓

- Highest temperature/*Hoogste temperatuur* ✓
- Largest surface area/ *Grootste reaksieoppervlak*✓ (3)

5.2

5.2.1 Temperature/Surface area/State of division. ✓
Temperatuur/Reaksieoppervlak/Toestand van verdeedheid (1)

5.2.2 Equal to/*Gelyk aan* ✓
Number/amount of mol/mass of Mg used is the same. ✓
Hoeveelheid mol/massa Mg is dieselfde (2)

5.3 More than ONE independent variable/*Meer as EEN onafhanklike veranderlike*✓ (1)

5.4 n(HCℓ) initial/*aanvanklik* = c.V ✓

= 2 x 80/1 000 ✓

= 0,16 mol

n(Mg)reacting/*reageer* = m/M

= 0.24/24 ✓

= 0.01 mol

n(HCℓ)reacting/*reageer* = 2 x 0.01 ✓

= 0.02 mol

n (HCℓ)remaining/*oorbly* = 0.16 – 0.02 ✓

= 0.14 mol

m(HCℓ)remaining/*oorbly* = nM

= 0.14 x 36,5 ✓

= 5,11 g ✓ (7)

5.5 5.5.1 Number/Fraction of molecules/particles/*aantal deeltjies* ✓ (1)

5.5.2 P ✓ (1)

5.5.3 Increase in temperature/*Toename in temperatuur*

- Increases (average) kinetic energy of particles. ✓/*Verhoog die (gemiddelde) kinetiese energie van deeltjies*
- More particles have enough/sufficient (kinetic) energy to react./EK ≥ EA ✓/*Meer deeltjies het genoeg (kinetiese) energie om te reageer*
- More effective collisions per unit time/second. ✓ OR Rate/Frequency of effective collisions increases./*Meer effektiewe botsings per eenheidstyd OF Reaksietempo van effektiewe botsings verhoog*
- Increases reaction rate ✓/*Toename in reaksietempo* (4)

[22]

QUESTION 6/*VRAAG* 6

6.1 The minimum energy required ✓ for a chemical reaction to start. ✓
Minimum hoeveelheid energie benodig om 'n reaksie te begin/aktiveer. (2)

6.2 Endothermic, ✓because energy is absorbed/E_k of reactants > E_k of products ✓✓
Endotermies, want energie word geabsorbeer/E_k van reaktante > E_k van produkte (3)

6.3 6.3.1 RP = Δ H/Heat of reaction/Enthalpy ✓
RP = Δ H/Reaksie warmte/Entalpie (1)

6.3.2 QP = Activation energy/*Aktiveringsenergie* ✓ (1)

6.4 ΔH reaction/*reaksie* = H products/*produkte* – H reactants/*reaktante* ✓

- 216,7 = H products/*produkte* – 400 ✓ H reactants/*reaktante*

(X) = 183,3 ✓ ($kJ \cdot mol^{-1}$) (3)

6.5 DECREASES/*AFNEEM* ✓ (1)
[11]

QUESTION 7/*VRAAG 7*

7.1 The rate of forward reaction equals to the rate of reverse reaction. ✓✓
Die tempo van die voorwaartse reaksie is dieselfde as die tempo van die terugwaartse reaksie. (2)

7.2 Higher than/*Hoër as* ✓ (1)

7.3 **Marking criteria/*Nasienkriteria:***

- n($C\ell_2$) equilibrium/*ewewig* = 0,6 mol ✓
- Substitute/*Vervang* m(H_2O) into/*in* n=m/M ✓
- using the correct mole ratio/*gebruik korrekte mol verhouding* ✓
- calculate the quantity (mol) at equilibrium of all three substances ✓
  bereken die hoeveelheid (mol) by ewewig van al drie verbindings
- divide number of moles at equilibrium by 5 ✓
  deel die aantal mol by ewewig deur 5
- Kc expression/*vergelyking* ✓
- Correct substitution of equilibrium concentrations in to Kc expression ✓
  Korrekte vervanging van ewewig konsentrasie in die Kc vergelyking
- Final answer/*Finale antwoord* ✓

OPTION 1 :CALCULATION USING NUMBER OF MOLES
OPSIE 1: BEREKENINGE WAT GETAL MOL GEBRUIK

	$HC\ell$	O_2	H_2O	$C\ell_2$
Ratio/*Verhouding*	4	1	2 ✓	2
Initial quantity/*Aanvanklike hoeveelheid* (mol)	1,5	2	1	0
Change/*Verandering* (mol)	1,2	0,3	0,6	0,6 ✓
Quantity at equilibrium / *Hoeveelheid by ewewig* (mol)	0,3	1,7	1,6 ✓	0.6 ✓
Equilibrium concentration / *Ewewigs konsentrasie* ($mol.dm^{-3}$)	0,06	0,34	0,32	0,12 ✓

$$Kc = \frac{[H_2O]^2 \cdot [C\ell_2]^2}{[HC\ell]^4 \cdot [O_2]} \quad ✓$$

$$Kc = \frac{(0,32)^2 \cdot (0,12)^2}{(0,06)^4 \cdot (0,34)} \quad ✓$$

Kc = 334,64✓

(8)

OPTION 2 :CALCULATION USING CONCENTRATION
OPSIE 2: BEREKENINGE WAT KONSENTRASIE GEBRUIK

	$HC\ell$	O_2	H_2O	$C\ell_2$
Ratio/*Verhouding*	4	1	2✓	2
Initial conc./*Aanvanklike konsentrasie* (moℓ.dm^{-3})	0.30	0.40	0.2	0
Change in conc./*Verandering in konsentrasie* (moℓ.dm^{-3})	-0.24	-0.06	+0.12✓	+0.12✓
Equilibrium conc./*Ewewigs konsentrasie* (moℓ.dm^{-3})	0.06	0.34	0.32✓	0.12✓

$$Kc = \frac{[H_2O]^2 \cdot [C\ell_2]^2}{[HC\ell]^4 \cdot [O_2]} \quad ✓$$

$$Kc = \frac{(0,32)^2 \cdot (0,12)^2}{(0,06)^4 \cdot (0,34)} \quad ✓$$

Kc = 334,64✓

7.4 **Marking criteria/*Nasienkriteria:***
If any one of the underlined key phrases in the correct context is omitted, deduct 1 mark
The underlined phrases must be in the correct context.
Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is,trek 1 punt af.
Die onderstreepte frases moet in die korrekte konteks wees.

When equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose/cancel the disturbances✓✓

Wanneer die ewewig in 'n geslote sisteem versteur word, sal die sisteem 'n nuwe ewewig instel deur die reaksie wat die versteuring teenwerk, te bevoordeel. (2)

7.5.1 REMAINS THE SAME/*BLY DIESELFDE* ✓ (1)

7.5.2 Increases/*Verhoog* ✓ (1)

7.6 An increase in pressure favours the reaction that produces a fewer number of moles. ✓The forward reaction is favoured ✓

'n Toename in druk bevoordeel die reaksie wat minder mol produseer. Die voorwaartse reaksie word bevoordeel. (2)

7.7.1 Lower than/*Kleiner as*✓ (1)

7.7.2 When the temperature increases the reverse reaction is favoured ✓ An increase in temperature favours the endothermic reaction. ✓

As die temperatuur verhoog sal die terugwaartse reaksie bevoordeel word. 'n Toename in temperatuur bevoordeel die endotermiese reaksie. (2)
[20]

QUESTION 8/*VRAAG 8*

8.1. A solution of precisely known concentration. ✓✓
'n Oplossing waarvan die konsentrasie presies bekend is (2)

8.2 $C_2H_2O_4$/ $C_2O_4^{2-}$ ✓✓ and/*en* H_2O/ OH^- ✓✓ (4)

8.3 Weak acid; ✓ it ionises/dissociates incompletely/partially(in water) ✓✓
Swak suur; dit ioniseer/dissosieer nie volledig nie (2)

8.4

8.4.1 HCO_3^- ✓✓ (2)

8.4.2 CO_3^{2-} ✓✓ (2)

8.5.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**OPTION *3/OPSIE 3***
n = $\frac{m}{M}$✓ =$\frac{5,25}{98}$✓ ✓ = 0,054 mol✓	98 g ✓ : 1 mol 5,25 ✓ : 0,054 ✓✓	c = m/MV ✓ = 5,25/98x 0,25 ✓ =0,214 ✓ n = c V = 0,214 x 0,25 = 0,054 mol ✓

(4)

8.5.2 C = n/v ✓
C =0,054 /0,25✓

pH = -log[H_3O^+]✓
= -log[1,6 x 10^{-1}] ✓
[H_3O^+] = 0,79 mol·dm^{-3}✓ (5)
[22]

TOTAL/*TOTAAL*: 150

SUBJECT:	PHYSICAL SCIENCES PAPER 2	ASSESSMENT TASK:	2024 JUNE EXAM

QUESTION ANALYSIS GRID

		Cognitive Levels				Topics						Difficulty Levels		
							CHEMICAL CHANGE							
QUESTION	**Mark**	**Remembering (Recall)**	**Understanding (Comprehension)**	**Applying and Analysing**	**Evaluating and Creating (synthesis)**	**Organic molecules (Matter & Materials - 58 marks**	**Rate of reaction & energy change**	**chemical equilibrium**	**acids & bases**	**quantitative aspect of chemical change**	**TOTAL**	**Easy(15%)**	**Moderate (35%)**	**Difficult (40%)**
1.1 Organic Chem	2		2			2					2		2	
1.2 Organic chem	2		2			2					2		2	
1.3 Organic chem	2		2			2					2		2	
Activation energy	2		2				2				2		2	
1.5 Chemical equaton	2		2				2				2		2	
1.6 Rates of reaction	2			2				2			2			2
1.7 Chemical equilibruim	2		2						2		2	2		2
1.8 Acid base	2		2						2		2		2	
1.9 Acids & Bases	2			2					2		2			2
1.10. Acids & Bases	2			2					2		2			2
Ques 1	**20**	**0**	**14**	**6**	**0**	**6**	**4**	**2**	**8**	**0**	**20**	**2**	**12**	**8**
2.1.1 Isomers	2	2				2					2	2		
2.1.2.Alchols	1	1				1					1	1		
2. 1.3 Acids	2		2			2					2		2	
2.2.1. IUPAC	3		3			3					3		2	
2.2.2. Strucural formula	3			3		3					3			3
2.2.3 IUPAC Name	2			2		2					2			2
2.3. Homologous series	1	1				1					1	1		
2.4.1 IUPAC Name.	2		2			2					2		2	
2.4.2 Alcohol	1			1		1					1			1
2.4.3 IUPAC Name	2		2			2					2		2	
2.5.1Functional Isomer	2		2			2					2		2	
2.5.2 Functional Isomers	2		2			2					2		2	
Ques 2	**22**	**4**	**9**	**6**	**0**	**23**	**0**	**0**	**0**	**0**	**19**	**4**	**8**	**6**

3.1 vapour pressuret.	2		2			2					2		2	
3.2.1 Variable	1	1				1					1	1		
3.2.2 Variable	1			1		1					1			1
3.3.1 IMF	2	2				2					2	2		
3.4.1 Structural formula	2	2				2					2	2		
3.4.2 Structural formula	2			2		2					2			2
3.5 IMF	4		4			4					4		4	
Ques 3	**15**	**5**	**6**	**3**	**0**	**14**	**0**	**0**	**0**	**0**	**14**	**5**	**6**	**3**
4.1.1 Type of reaction	1		1			1					1		1	
4.1.2 Type of reaction	1		1			1					1		1	
4.1.3 Type of reaction	1		1			1					1		1	
4.2. IUPAC Name	2			2		2					2			2
4.3.1 Molecular Formula	2		2			2					2		2	
4.3.2 Molecular Formula	2		2			2					2		2	
4.4. Structural Formula	2			2		2					2			2
4.5. Structural Formula	2			2		2					2			2
4.6.1Structural Formula	2			2		2					2			2
4.6.2 Reaction conditions	2	2				2					2		2	
Ques 4	**18**		**7**	**8**	**0**	**17**	**0**	**0**	**0**	**0**	**17**	**0**	**9**	**8**
5.1.1 Rate of reaction	2		2				2			2	2	2		
5.1.2. Factors	3			3			3			3	3			3
5.2.1 Variable	1	1					1			1	1		1	
5..2.2 Reaction rate	2	2					2			2	2		2	
5.3 Reaction rate	1	1					1			1	1		1	
5.4 Calculation of mass	7			7			7			7	7			7
5.5.1 Graph	1		1				1				1		1	
5.5.2 Graph	1		1				1				1		1	
5.5.3 Collision Theory	4			4			4				4		4	
QUES 6	**22**	**4**	**4**	**14**	**0**	**0**	**22**	**0**	**0**	**16**	**22**	**2**	**10**	**10**
6.1 Activation energy	2	2								2	2	2		
6.2 Exothermic reactin	3		3							3	3		3	
6.3..1 Graph	1	1								1	1		1	
6.3.2 Graph	1	1								1	1		1	
6.4 Calculation	3			3						3	3			3
6.5 Catalyst	1			1						1	1		1	
QUES 6	**11**	**4**	**3**	**4**	**0**	**0**	**0**	**0**	**0**	**11**	**11**	**2**	**6**	**3**

7.1 Chemical equilibruim	2		2					1			1		1	
7.2 Equilibruim.	1	1						1			1		1	
7.3 Kc	8			8				8			8			8
7.4 Le Chateliers	2		2					2			2			2
7.5.1 Kc value	1	1						1			1			
7.6 Le Chateliers	1		1				1				1		1	
7.5.2 le Chateliers	2			2			2				2			2
7.7.1 Factors	1	1					1				1		1	
7.7.2 Factors	2			2			2				2		2	
QUES 7	**20**	**2**	**5**	**8**	**0**	**0**	**0**	**13**	**0**	**0**	**19**	**0**	**2**	**10**
8.1 Standard solution	2		2							2	2	2		
8.2 Conjugate pairs	4			4						4	4			4
8.3 Strong acid	3		3							3	3	3		
8.4.1 Ampholyte	2			2						2	2			2
8.4.2 Formula	2		2							2	2	2		
8.5.1 Calculation	4				4					4	4			
8.5.2 Calculation	5				5					5	5			
QUES 8	**22**	**0**	**7**	**6**	**9**	**0**	**0**	**0**	**0**	**22**	**22**	**7**	**0**	**6**
SUMMARY														
QUESTION 1	**20**	**0**	**14**	**6**	**0**	**6**	**4**	**2**	**8**	**0**	**20**	2	12	8
QUESTION 2	**22**	**4**	**9**	**6**	**0**	**23**	**0**	**0**	**0**	**0**	**19**	4	8	6
QUESTION 3	**15**	**5**	**6**	**3**	**0**	**14**	**0**	**0**	**0**	**0**	**14**	5	6	3
QUESTION 4	**18**	**0**	**7**	**8**	**0**	**17**	**0**	**0**	**0**	**0**	**17**	0	9	8
QUESTION 5	**22**	**4**	**4**	**14**	**0**	**0**	**22**	**0**	**0**	**16**	**22**	2	10	10
QUESTION 6	**11**	**4**	**3**	**4**	**0**	**0**	**0**	**0**	**0**	**11**	**11**	2	6	3
QUESTION 7	**20**	**2**	**5**	**8**	**0**	**0**	**0**	**13**	**0**	**0**	**19**	0	2	10
QUESTION 8	**22**	**0**	**7**	**6**	**9**	**0**	**0**	**0**	**0**	**22**	**22**	7	0	6
Total marks	**150**	**19**	**55**	**55**	**9**	**60**	**26**	**15**	**8**	**49**	**158**	**22**	**53**	**54**
Norm marks	**150**	**22,5**	**52,5**	**60**	**15**	**58**	**24**	**17**	**14**	**9**	**150**	**22,5**	**52,5**	**60**
Total %	**100**	**12,7**	**36,7**	**36,7**	**6,0**	**40,0**	**17**	**10,0**	**5,3**	**33**	**105**	**14,7**	**35,3**	**36,0**
Norm %	**100**	**15**	**35,0**	**40**	**10**	**34,7**	**65,3**				**100**	**15,0**	**35,0**	**40**