**DATA FOR PHYSICAL SCIENCES GRADE 12**

**PAPER 2 (CHEMISTRY)**

***GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12***

***VRAESTEL 2 (CHEMIE)***

**TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES***

|  |  |  |
| --- | --- | --- |
| **NAME/*NAAM*** | **SYMBOL/*SIMBOOL*** | **VALUE/*WAARDE*** |
| Standard pressure Standaarddruk |  | 1,013 x 105 Pa |
| Molar gas volume at STP Molêre gasvolume by STD | Vm | 22,4 dm3∙mol-1 |
| Standard temperature Standaardtemperatuur |  | 273 K |
| Charge on electron  *Lading op elektron* | e | -1,6 x 10-19 C |
| Avogadro's constant  *Avogadro-konstante* | NA | 6,02 x 1023 mol-1 |

**TABLE 2: FORMULAE/*TABEL 2: FORMULES***

|  |  |
| --- | --- |
|  |  |
| or/*of* |  |
|  | pH = -log[H3O+] |
| Kw = [H3O+][OH-] = 1 x 10-14 at/*by* 298 K | |
| /  or/*of*  /  or/*of*  / | |

# TABLE 3: THE PERIODIC TABLE OF ELEMENTS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1**  **(I)** | | **2**  **(II)** | | **3** | | **4**  **Electronegativity**  ***Elektronegatiwiteit***  **Approximate relative atomic mass**  ***Benaderde relatiewe atoommassa***  **Atomic number**  ***Atoomgetal***  **29**  **Cu**  **63,5**  **1,9**  **Symbol**  ***Simbool***  **KEY/*SLEUTEL*** | | **5** | | **6** | | **7** | | **8** | | **9** | | **10** | | **11** | | **12** | | **13**  **(III)** | | **14**  **(IV)** | | **15**  **(V)** | | **16**  **(VI)** | | **17**  **(VII)** | | **18**  **(VIII)** | |
| **2,1** | **1**  **H**  **1** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **2**  **He**  **4** |
| **1,0** | **3**  **Li**  **7** | **1,5** | **4**  **Be**  **9** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **2,0** | **5**  **B**  **11** | **2,5** | **6**  **C**  **12** | **3,0** | **7**  **N**  **14** | **3,5** | **8**  **O**  **16** | **4,0** | **9**  **F**  **19** |  | **10**  **Ne**  **20** |
| **0,9** | **11**  **Na**  **23** | **1,2** | **12**  **Mg**  **24** |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | | **1,5** | **13**  **Aℓ**  **27** | **1,8** | **14**  **Si**  **28** | **2,1** | **15**  **P**  **31** | **2,5** | **16**  **S**  **32** | **3,0** | **17**  **Cℓ**  **35,5** |  | **18**  **Ar**  **40** |
| **0,8** | **19**  **K**  **39** | **1,0** | **20**  **Ca**  **40** | **1,3** | **21**  **Sc**  **45** | **1,5** | **22**  **Ti**  **48** | **1,6** | **23**  **V**  **51** | **1,6** | **24**  **Cr**  **52** | **1,5** | **25**  **Mn**  **55** | **1,8** | **26**  **Fe**  **56** | **1,8** | **27**  **Co**  **59** | **1,8** | **28**  **Ni**  **59** | **1,9** | **29**  **Cu**  **63,5** | **1,6** | **30**  **Zn**  **65** | **1,6** | **31**  **Ga**  **70** | **1,8** | **32**  **Ge**  **73** | **2,0** | **33**  **As**  **75** | **2,4** | **34**  **Se**  **79** | **2,8** | **35**  **Br**  **80** |  | **36**  **Kr**  **84** |
| **0,8** | **37**  **Rb**  **86** | **1,0** | **38**  **Sr**  **88** | **1,2** | **39**  **Y**  **89** | **1,4** | **40**  **Zr**  **91** |  | **41**  **Nb**  **92** | **1,8** | **42**  **Mo**  **96** | **1,9** | **43**  **Tc** | **2,2** | **44**  **Ru**  **101** | **2,2** | **45**  **Rh**  **103** | **2,2** | **46**  **Pd**  **106** | **1,9** | **47**  **Ag**  **108** | **1,7** | **48**  **Cd**  **112** | **1,7** | **49**  **In**  **115** | **1,8** | **50**  **Sn**  **119** | **1,9** | **51**  **Sb**  **122** | **2,1** | **52**  **Te**  **128** | **2,5** | **53**  **I**  **127** |  | **54**  **Xe**  **131** |
| **0,7** | **55**  **Cs**  **133** | **0,9** | **56**  **Ba**  **137** |  | **57**  **La**  **139** | **1,6** | **72**  **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** | **1,8** | **81**  **Tℓ**  **204** | **1,8** | **82**  **Pb**  **207** | **1,9** | **83**  **Bi**  **209** | **2,0** | **84**  **Po** | **2,5** | **85**  **At** |  | **86**  **Rn** |
| **0,7** | **87**  **Fr** | **0,9** | **88**  **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** | |

***TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE***

**TABLE 4A: STANDARD REDUCTION POTENTIALS**

***TABEL 4A: STANDAARDREDUKSIEPOTENSIALE***

|  |  |  |  |
| --- | --- | --- | --- |
| **Half-reactions/*Halfreaksies*** | | | **(V)** |
| F2(g) + 2e− | ⇌ | 2F− | + 2,87 |
| Co3+ + e− | ⇌ | Co2+ | + 1,81 |
| H2O2 + 2H+ +2e− | ⇌ | 2H2O | +1,77 |
| MnO + 8H+ + 5e− | ⇌ | Mn2+ + 4H2O | + 1,51 |
| Cℓ2(g) + 2e− | ⇌ | 2Cℓ− | + 1,36 |
| Cr2O + 14H+ + 6e− | ⇌ | 2Cr3+ + 7H2O | + 1,33 |
| O2(g) + 4H+ + 4e− | ⇌ | 2H2O | + 1,23 |
| MnO2+ 4H+ + 2e− | ⇌ | Mn2+ + 2H2O | + 1,23 |
| Pt2+ + 2e−  **Increasing oxidising ability/*Toenemende oksiderende vermoë*** | ⇌ | Pt | + 1,20  **Increasing reducing ability/*Toenemende reduserende vermoë*** |
| Br2(ℓ) + 2e− | ⇌ | 2Br− | + 1,07 |
| NO + 4H+ + 3e− | ⇌ | NO(g) + 2H2O | + 0,96 |
| Hg2+ + 2e− | ⇌ | Hg(ℓ) | + 0,85 |
| Ag+ + e− | ⇌ | Ag | + 0,80 |
| NO + 2H+ + e− | ⇌ | NO2(g) + H2O | + 0,80 |
| Fe3+ + e− | ⇌ | Fe2+ | + 0,77 |
| O2(g) + 2H+ + 2e− | ⇌ | H2O2 | + 0,68 |
| I2 + 2e− | ⇌ | 2I− | + 0,54 |
| Cu+ + e− | ⇌ | Cu | + 0,52 |
| SO2 + 4H+ + 4e− | ⇌ | S + 2H2O | + 0,45 |
| 2H2O + O2 + 4e− | ⇌ | 4OH− | + 0,40 |
| Cu2+ + 2e− | ⇌ | Cu | + 0,34 |
| SO + 4H+ + 2e− | ⇌ | SO2(g) + 2H2O | + 0,17 |
| Cu2+ + e− | ⇌ | Cu+ | + 0,16 |
| Sn4+ + 2e− | ⇌ | Sn2+ | + 0,15 |
| S + 2H+ + 2e− | ⇌ | H2S(g) | + 0,14 |
| **2H+ + 2e−** | **⇌** | **H2(g)** | **0,00** |
| Fe3+ + 3e− | ⇌ | Fe | − 0,06 |
| Pb2+ + 2e− | ⇌ | Pb | − 0,13 |
| Sn2+ + 2e− | ⇌ | Sn | − 0,14 |
| Ni2+ + 2e− | ⇌ | Ni | − 0,27 |
| Co2+ + 2e− | ⇌ | Co | − 0,28 |
| Cd2+ + 2e− | ⇌ | Cd | − 0,40 |
| Cr3+ + e− | ⇌ | Cr2+ | − 0,41 |
| Fe2+ + 2e− | ⇌ | Fe | − 0,44 |
| Cr3+ + 3e− | ⇌ | Cr | − 0,74 |
| Zn2+ + 2e− | ⇌ | Zn | − 0,76 |
| 2H2O + 2e− | ⇌ | H2(g) + 2OH− | − 0,83 |
| Cr2+ + 2e− | ⇌ | Cr | − 0,91 |
| Mn2+ + 2e− | ⇌ | Mn | − 1,18 |
| Aℓ3+ + 3e− | ⇌ | Aℓ | − 1,66 |
| Mg2+ + 2e− | ⇌ | Mg | − 2,36 |
| Na+ + e− | ⇌ | Na | − 2,71 |
| Ca2+ + 2e− | ⇌ | Ca | − 2,87 |
| Sr2+ + 2e− | ⇌ | Sr | − 2,89 |
| Ba2+ + 2e− | ⇌ | Ba | − 2,90 |
| Cs+ + e- | ⇌ | Cs | - 2,92 |
| K+ + e− | ⇌ | K | − 2,93 |
| Li+ + e− | ⇌ | Li | − 3,05 |

**TABLE 4B: STANDARD REDUCTION POTENTIALS**

***TABEL 4B: STANDAARDREDUKSIEPOTENSIALE***

|  |  |  |  |
| --- | --- | --- | --- |
| **Half-reactions/*Halfreaksies*** | | | **(V)** |
| Li+ + e− | ⇌ | Li | − 3,05 |
| K+ + e− | ⇌ | K | − 2,93 |
| Cs+ + e− | ⇌ | Cs | − 2,92 |
| Ba2+ + 2e− | ⇌ | Ba | − 2,90 |
| Sr2+ + 2e− | ⇌ | Sr | − 2,89 |
| Ca2+ + 2e− | ⇌ | Ca | − 2,87 |
| Na+ + e− | ⇌ | Na | − 2,71 |
| Mg2+ + 2e− | ⇌ | Mg | − 2,36 |
| Aℓ3+ + 3e− | ⇌ | Aℓ | − 1,66 |
| Mn2+ + 2e− | ⇌ | Mn | − 1,18 |
| Cr2+ + 2e− | ⇌ | Cr | − 0,91 |
| 2H2O + 2e− | ⇌ | H2(g) + 2OH− | − 0,83 |
| Zn2+ + 2e− | ⇌ | Zn | − 0,76 |
| Cr3+ + 3e− | ⇌ | Cr | − 0,74 |
| Fe2+ + 2e− | ⇌ | Fe | − 0,44 |
| Cr3+ + e− | ⇌ | Cr2+ | − 0,41 |
| Cd2+ + 2e− | ⇌ | Cd | − 0,40 |
| Co2+ + 2e− | ⇌ | Co | − 0,28 |
| Ni2+ + 2e− | ⇌ | Ni | − 0,27 |
| Sn2+ + 2e− | ⇌ | Sn | − 0,14 |
| Pb2+ + 2e− | ⇌ | Pb | − 0,13 |
| Fe3+ + 3e− | ⇌ | Fe | − 0,06 |
| **2H+ + 2e−** | **⇌** | **H2(g)** | **0,00** |
| S + 2H+ + 2e− | ⇌ | H2S(g) | + 0,14 |
| Sn4+ + 2e− | ⇌ | Sn2+ | + 0,15 |
| Cu2+ + e− | ⇌ | Cu+ | + 0,16 |
| SO + 4H+ + 2e− | ⇌ | SO2(g) + 2H2O | + 0,17 |
| Cu2+ + 2e− | ⇌ | Cu | + 0,34 |
| 2H2O + O2 + 4e− | ⇌ | 4OH− | + 0,40 |
| SO2 + 4H+ + 4e− | ⇌ | S + 2H2O | + 0,45 |
| Cu+ + e− | ⇌ | Cu | + 0,52 |
| I2 + 2e− | ⇌ | 2I− | + 0,54 |
| O2(g) + 2H+ + 2e− | ⇌ | H2O2 | + 0,68 |
| Fe3+ + e− | ⇌ | Fe2+ | + 0,77 |
| NO + 2H+ + e− | ⇌ | NO2(g) + H2O | + 0,80 |
| Ag+ + e− | ⇌ | Ag | + 0,80 |
| Hg2+ + 2e− | ⇌ | Hg(ℓ) | + 0,85 |
| NO + 4H+ + 3e− | ⇌ | NO(g) + 2H2O | + 0,96 |
| Br2(ℓ) + 2e− | ⇌ | 2Br− | + 1,07 |
| Pt2+ + 2 e− | ⇌ | Pt | + 1,20 |
| MnO2+ 4H+ + 2e− | ⇌ | Mn2+ + 2H2O | + 1,23 |
| O2(g) + 4H+ + 4e− | ⇌ | 2H2O | + 1,23 |
| Cr2O + 14H+ + 6e− | ⇌ | 2Cr3+ + 7H2O | + 1,33 |
| Cℓ2(g) + 2e− | ⇌ | 2Cℓ− | + 1,36 |
| MnO + 8H+ + 5e− | ⇌ | Mn2+ + 4H2O | + 1,51 |
| H2O2 + 2H+ +2 e− | ⇌ | 2H2O | +1,77 |
| Co3+ + e− | ⇌ | Co2+ | + 1,81 |
| F2(g) + 2e− | ⇌ | 2F− | + 2,87 |

**Increasing oxidising ability/*Toenemende oksiderende vermoë***

**Increasing reducing ability/*Toenemende reduserende vermoë***