**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 pressureStandaarddruk |  | 1,013 x 105 Pa |
| Molar gas volume at STPMolêre gasvolume by STD | Vm | 22,4 dm3∙mol-1 |
| Standard temperatureStandaardtemperatuur |  | 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***