



# Rare Earth Systems

## The leader in rare earth value chain

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*General Manager,  
Rare Earth Systems*



April 24, 2012

# AGENDA

- 1 • **Our positioning and strengths**
- 2 • **Our strategy**
- 3 • **Our growth ambition**



# 1. Our positioning and strengths



# Rare Earth Systems at a glance

A **unique** global footprint

**2011 Net Sales**

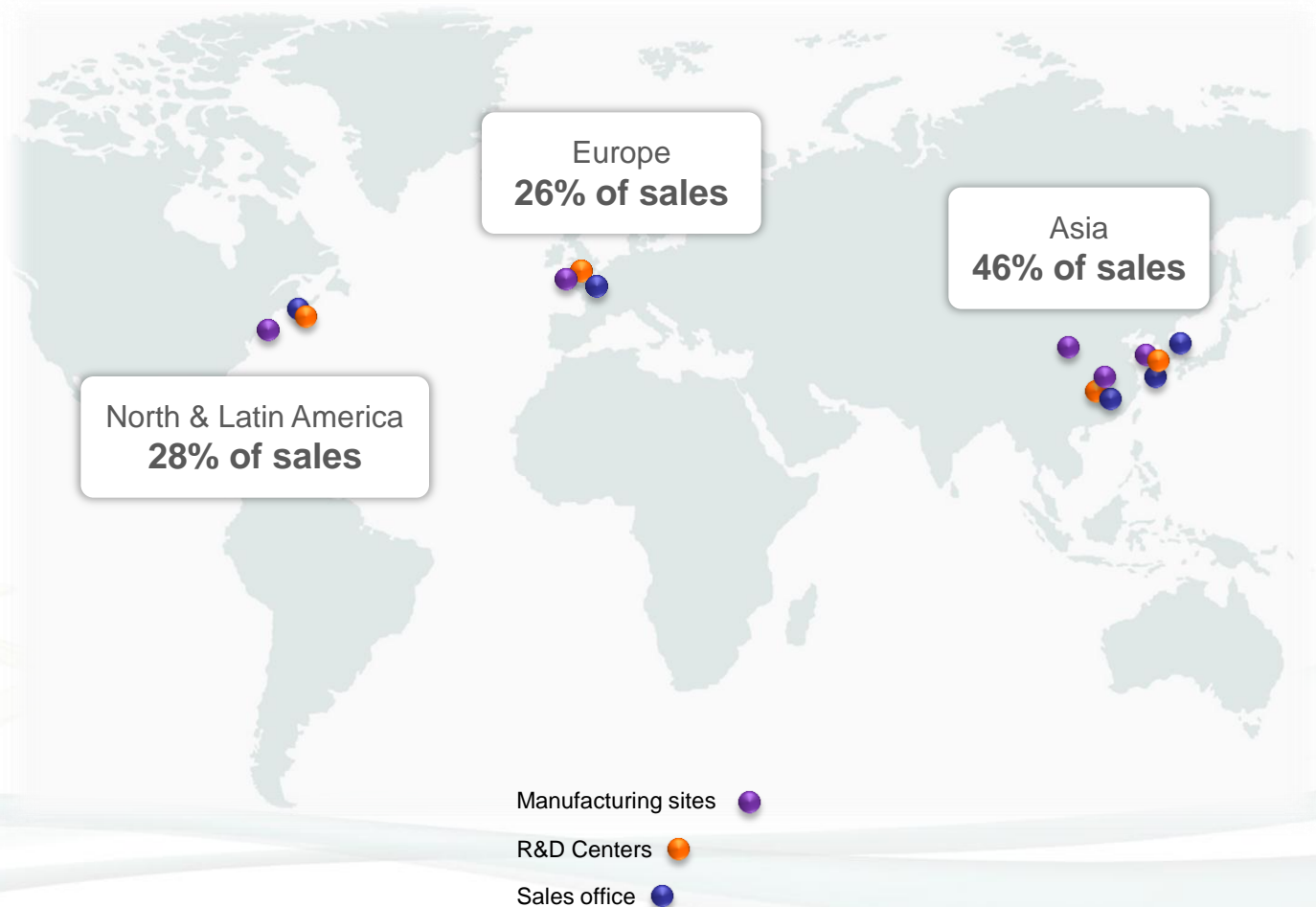
> € 500m

**Employees**

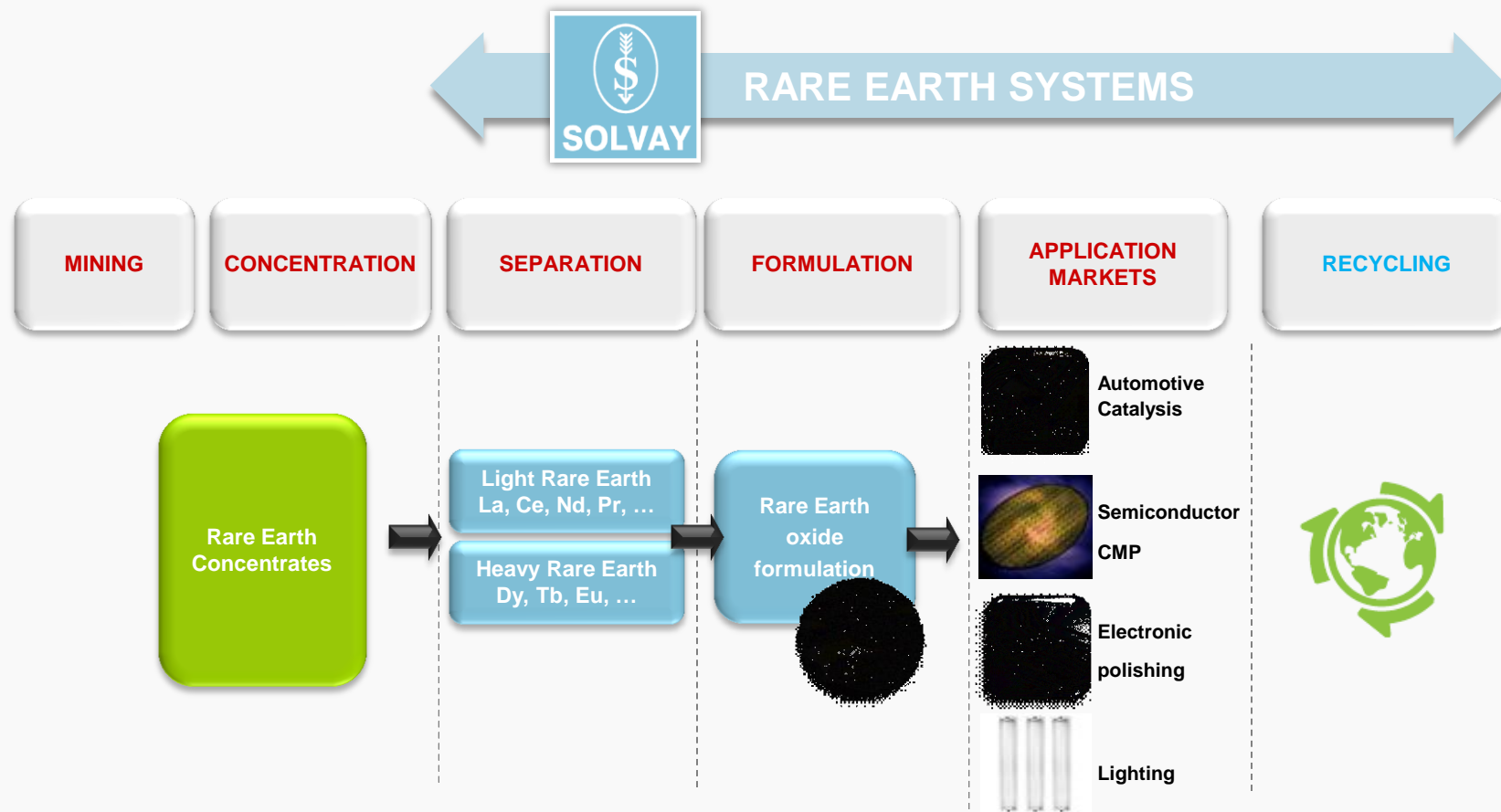
> 1000

**# 1 in rare earth  
based specialty  
chemicals**

**Sales, R&D and  
industrial footprint  
close to our target  
markets and target  
customers**



# Differentiated positioning in the rare earth value chain



# Covering the widest range of applications

## AUTOMOTIVE CATALYST



### KEY PRODUCTS

#### **GASOLINE**

Mixed oxides : Actalys®, Optalys®  
Alumina : Stabylis®

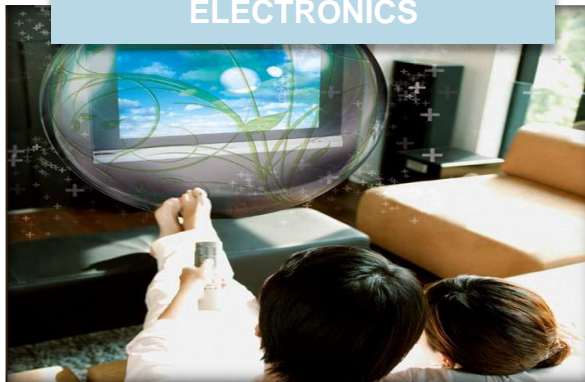
#### **DIESEL**

Additives : Eolys®, Powerflex®  
Mixed oxides : HSA®, Actalys®, Optalys®  
Alumina : Stabylis®

#### **CHEMCAT**

Precursor : Nd Versatate and Phosphates

## ELECTRONICS



### KEY PRODUCTS

#### **LIGHTING**

Phosphors Precursor : Luminostar®, Morningstar®

#### **HIGH END POLISHING**

LCD, Glass Hard Disk, Photomask  
Cerium oxides : Cerox®

#### **SEMICONDUCTOR CMP**

High Purity Cerium : HPCC  
Colloidal Cerium

#### **eCERAMIC**

Dy & Y oxides : Superamic®

#### **MEDICAL DEVICES**

High purity rare earth oxides

#### **ENVIRONMENTAL FRIENDLY PIGMENTS**

Cerium derivatives : Neolor®

#### **NUCLEAR ENERGY**

High purity rare earth oxides

## RECYCLING & SEPARATION



### KEY PRODUCTS

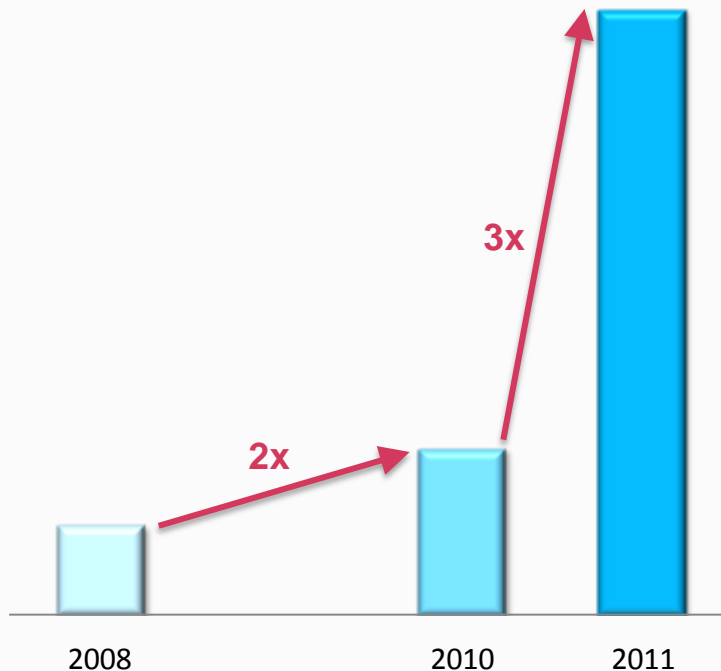
**Recycling of Phosphors powders**

**Recycling of Permanent Magnets**

**Heavy Rare Earth Separation**

# 2011, an outstanding year capitalizing on our unique positioning

## 2008 - 2011 REBITDA



### 2011, an exceptional year

- Drastic reduction of China export quotas mid 2010
- Unprecedented raw materials price increases

### 2011 Business achievements

- Managed and enhanced security of supply to our customers
- Reshaped business portfolio focusing on specialty high-added value segments
- Gained significant market share
- Enhanced global footprint



## 2. Our strategy





# Leveraging our unique compelling positioning

## Combining our four differentiated key pillars

Security of supply

Industrial expertise

Technology innovation

Global footprint

# Sourcing diversification strategy to secure supply

Currently



Going forward

Enjoying access to

**Export quotas**

**Key players  
in China**

Over 95% of Rare Earth production  
sourced from China

**LIGHT RARE EARTH**

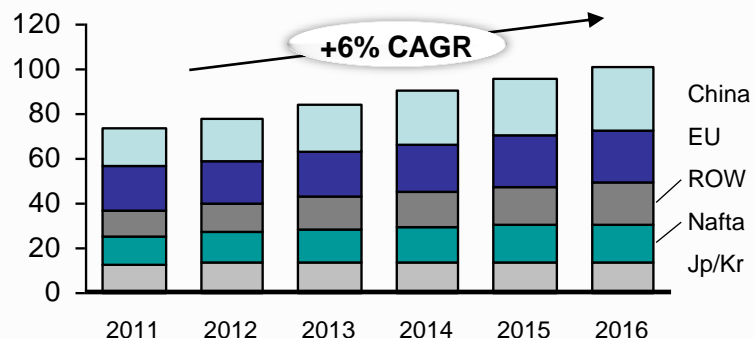
- *Strategic agreement with LYNAS*
- *2nd strategic agreement out of China will be closed in 2012*

**HEAVY RARE EARTH (HRE)**

- *Strategic agreement with CHINALCO*
- *Actively assessing new HRE mining options out of China*

# Enhancing leadership position in automotive catalysis market

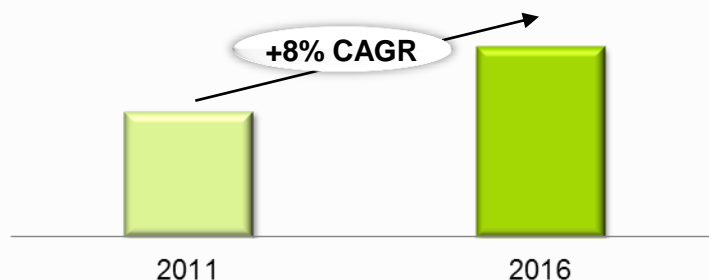
## Light Vehicles Gasoline and Diesel Car Production (Million units)



### MARKET DRIVERS

More demanding emission control **regulations**  
**Car** production **volume** in China

## Mixed oxides market evolution (Tonnes)

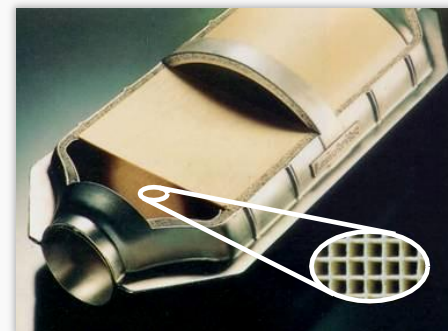


2011 Market Share > 35%

Mixed oxides production start-up in China : 2012

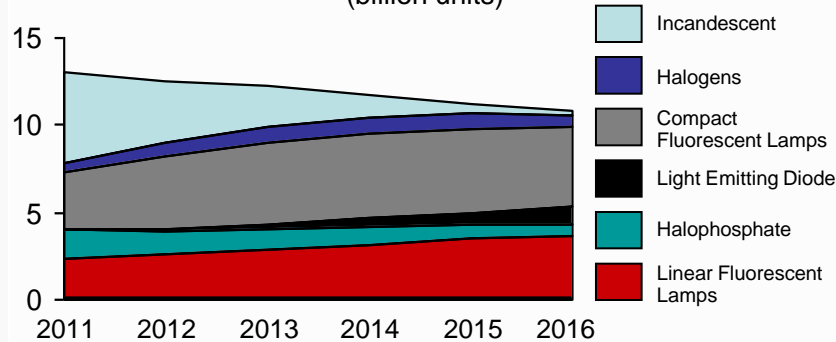
## 2016 Strategy

- Leverage high performance products and strong IP portfolio
- Global production footprint to support our global customers
- Asia, NA and EU R&D labs close to our customers development centers



## Building leadership in Green and Red Phosphor precursor for Linear Fluorescent Lamps (LFL)

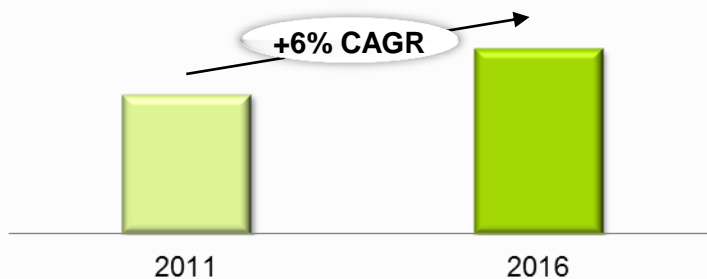
**Number of Lamps in billion units per year**  
(billion units)



### MARKET DRIVERS

Energy saving **regulations**  
Replacement of halophosphates lamps  
**Recycling** is key market trend

**LFL Phosphors precursor overseas market**  
(Tonnes)



2011 Market Share > 20%

### 2016 Strategy

- Groundbreaking Morningstar® technology innovation reducing terbium consumption



- Unique Phosphors powders Recycling process



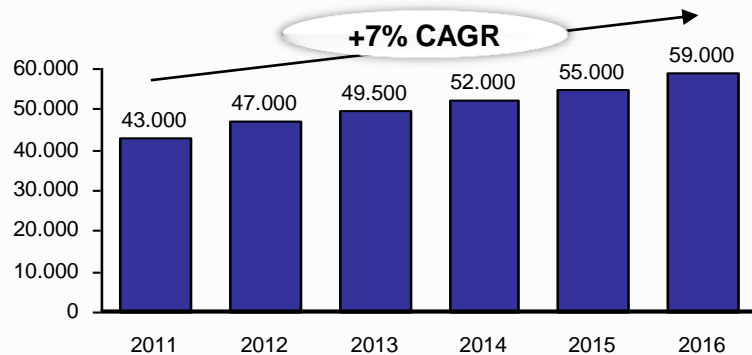
- Security of supply with our dual supply chain



Sources : Freedonia, Strategies unlimited, Internal analysis

## Building leadership in semiconductor Chemical Mechanical Planarization (CMP)

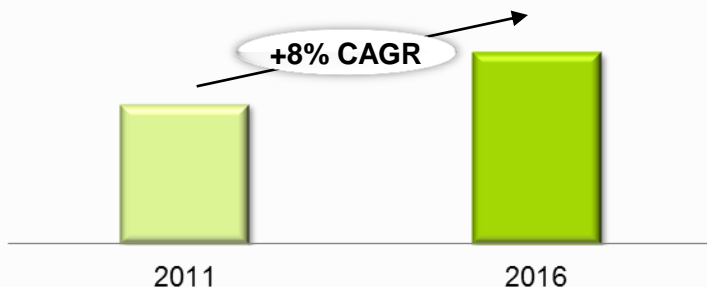
**Produced wafer surface** (8-Inch equivalents, x 1,000)



### MARKET DRIVERS

**Consumption** of mobile devices & Miniaturization  
Increasing **needs in memories and logics**  
Strong **regional dynamics** in Korea and Japan

**Specialty Ce market evolution**  
(Tonnes)

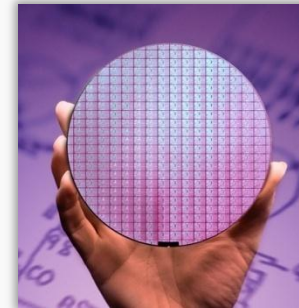


2011 Market Share > 40%

Cerium is the next generation technology compared to Silica

### 2016 Strategy

- Leverage groundbreaking Colloidal Cerium innovation and strong IP portfolio to drive business growth in Asia (namely Japan and Korea)
- Security of supply and high end manufacturing facilities for targeted customers



# Leading rare earth recycling in selected market segments

## Recycling initiatives



**LINEAR and COMPACT FLUORESCENT LAMPS**  
New recycling business starting in 2012 in France

**PERMANENT MAGNETS**

**NICKEL METAL HYBRID BATTERIES**

# The preferred partner for new Heavy Rare Earth mining separation project

### Long track record in rare earth industry

### Expertise in ore processing

Monazite, Xenotime, Apatite, Bastnasite, and Ionic ores  
(Soda, Chloride, Nitrate and Sulfuric routes)

### Expertise in rare earths separation

RES is the only player mastering the separation process with Nitrate and Chloride route. We have unique industrial footprint with separation assets in France and in China.

**Industrial expertise and know-how, valued by mining companies allow us to develop upcoming heavy rare earths separation business**



As from 2013, Rare earths separation batteries in La Rochelle (France)



# 3. Our growth ambition

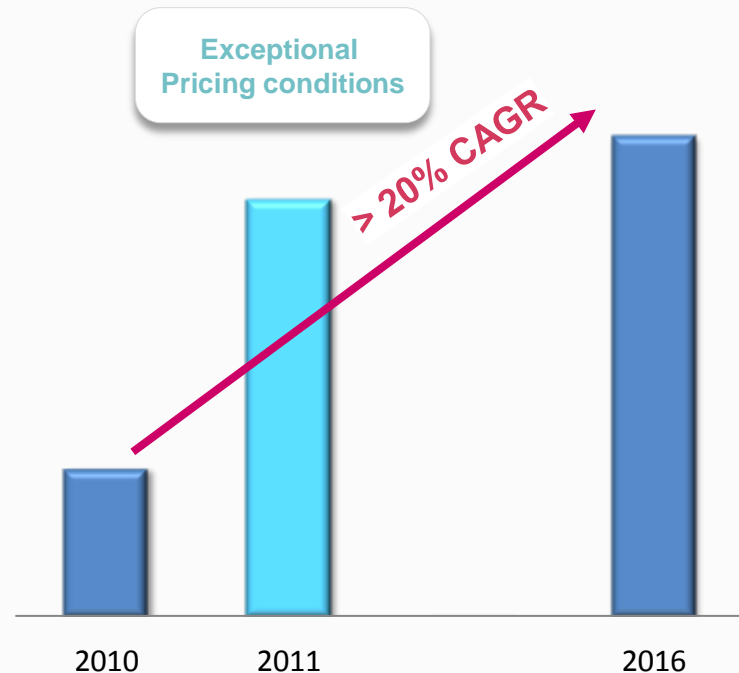


April 24, 2012

## Committed to outperform market growth

- Recognized specialty chemical leader in the rare earth value chain
- Differentiated strengths in technology innovation, industrial expertise, global footprint and security of supply
- Strong business portfolio in high-tech high growth markets of Automotive Catalysis and Lighting & Electronics
- Moving aggressively in Recycling and Heavy Rare Earth separation

### 2010 - 2016 EBITDA



# Appendix

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a Passion for Progress®

# Where do the rare-earths stand in the Mendeleiev table?

1 <b>H</b> 1.008																	18 <b>He</b> 4.003														
3 <b>Li</b> 6.941	4 <b>Be</b> 9.012																	10 <b>Ne</b> 20.180													
11 <b>Na</b> 22.990	12 <b>Mg</b> 24.305																	18 <b>Ar</b> 39.948													
		13 <b>B</b> 10.811	14 <b>C</b> 12.011	15 <b>N</b> 14.007	16 <b>O</b> 15.999	17 <b>F</b> 18.998	19 <b>Ne</b> 20.180											36 <b>Kr</b> 83.798													
		29 <b>Cu</b> 63.546	30 <b>Zn</b> 65.409	31 <b>Ga</b> 69.723	32 <b>Ge</b> 72.641	33 <b>As</b> 74.922	34 <b>Se</b> 78.963	35 <b>Br</b> 79.904	36 <b>Kr</b> 83.798											54 <b>Xe</b> 131.29											
		47 <b>Ag</b> 107.868	48 <b>Cd</b> 112.412	49 <b>In</b> 114.818	50 <b>Sn</b> 118.711	51 <b>Sb</b> 121.760	52 <b>Te</b> 127.603	53 <b>I</b> 126.904	54 <b>Xe</b> 131.29											86 <b>Rn</b> [222]											
		63 <b>Eu</b> 151.964	64 <b>Gd</b> 157.022	65 <b>Tb</b> 158.925	66 <b>Dy</b> 162.502	67 <b>Ho</b> 164.930	68 <b>Er</b> 167.259	69 <b>Tm</b> 168.933	70 <b>Yb</b> 173.054	71 <b>Lu</b> 174.967	72 <b>Hf</b> 178.492	73 <b>Ta</b> 180.948	74 <b>W</b> 183.841	75 <b>Re</b> 186.207	76 <b>Os</b> 190.233	77 <b>Ir</b> 192.217	78 <b>Pt</b> 195.084	79 <b>Au</b> 196.966	80 <b>Hg</b> 200.592	81 <b>Tl</b> 204.383	82 <b>Pb</b> 207.21	83 <b>Bi</b> 208.980	84 <b>Po</b> [209]	85 <b>At</b> [210]	86 <b>Rn</b> [222]						
		87 <b>Fr</b> [223]	88 <b>Ra</b> [226]																	112 <b>Cn</b> [285]											
		101 <b>La</b> 138.905	102 <b>Ce</b> 140.12	103 <b>Pr</b> 140.908	104 <b>Nd</b> 144.24	105 <b>Pm</b> [145]	106 <b>Sm</b> 150.36	107 <b>Eu</b> 151.964	108 <b>Gd</b> 157.022	109 <b>Tb</b> 158.925	110 <b>Dy</b> 162.502	111 <b>Ho</b> 164.930	112 <b>Er</b> 167.259	113 <b>Tm</b> 168.933	114 <b>Yb</b> 173.054	115 <b>Lu</b> 174.967	116 <b>Hf</b> 178.492	117 <b>Ta</b> 180.948	118 <b>W</b> 183.841	119 <b>Re</b> 186.207	120 <b>Os</b> 190.233	121 <b>Ir</b> 192.217	122 <b>Pt</b> 195.084	123 <b>Au</b> 196.966	124 <b>Hg</b> 200.592	125 <b>Tl</b> 204.383	126 <b>Pb</b> 207.21	127 <b>Bi</b> 208.980	128 <b>Po</b> [209]	129 <b>At</b> [210]	130 <b>Rn</b> [222]

Lanthanoids	57 <b>La</b> 138.905	58 <b>Ce</b> 140.116	59 <b>Pr</b> 140.908	60 <b>Nd</b> 144.242	61 <b>Pm</b> [145]	62 <b>Sm</b> 150.362	63 <b>Eu</b> 151.964	64 <b>Gd</b> 157.253	65 <b>Tb</b> 158.925	66 <b>Dy</b> 162.500	67 <b>Ho</b> 164.930	68 <b>Er</b> 167.259	69 <b>Tm</b> 168.934	70 <b>Yb</b> 173.043	71 <b>Lu</b> 174.967
Actinoids	89 <b>Ac</b> [227]	90 <b>Th</b> 232.038	91 <b>Pa</b> 231.036	92 <b>U</b> 238.029	93 <b>Np</b> [237]	94 <b>Pu</b> [244]	95 <b>Am</b> [243]	96 <b>Cm</b> [247]	97 <b>Bk</b> [247]	98 <b>Cf</b> [251]	99 <b>Es</b> [252]	100 <b>Fm</b> [257]	101 <b>Md</b> [258]	102 <b>No</b> [259]	103 <b>Lr</b> [262]

57 <b>La</b> 138.91	58 <b>Ce</b> 140.12	59 <b>Pr</b> 140.91	60 <b>Nd</b> 144.24	62 <b>Sm</b> 150.36	63 <b>Eu</b> 151.96	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.93	66 <b>Dy</b> 162.5	67 <b>Ho</b> 164.93	68 <b>Er</b> 167.26	69 <b>Tm</b> 168.93	70 <b>Yb</b> 173.04	71 <b>Lu</b> 174.97	39 <b>Y</b> 88.906
Light rare earths					Heavy rare earths									

La - Lanthanum  
Ce - Cerium  
Pr - Praseodymium  
Nd - Neodymium  
Sm - Samarium

Eu - Europium  
Gd - Gadolinium  
Tb - Terbium  
Dy - Dysprosium  
Ho - Holmium

Er - Erbium  
Tm - Thulium  
Yb - Ytterbium  
Lu - Lutetium  
Y - Yttrium

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