METODE ILMIAH
(SDA620306)

DATA DAN VARIABEL

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PENYEGARAN

Sumber:
Jearl Walker, David Halliday, Robert Resnick. 2014. Fundamentals of physics 10th edition. John Wiley & Sons, Inc.

Prefixes for SI Units

Power	Prefix	Abbreviation
10^{-24}	yocto	y
10^{-21}	zepto	z
10^{-18}	atto	a
10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
10^{1}	deka	da
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T
10^{15}	peta	P
10^{18}	exa	E
10^{21}	zetta	Z
10^{24}	yotta	Y

THE SI UNITS

Quantity	Name	Symbol	Definition
length	meter	m	"... the length of the path traveled by light in vacuum in 1/299,792,458 of a second." (1983)
mass	kilogram	kg	"... this prototype [a certain platinum–iridium cylinder] shall henceforth be considered to be the unit of mass." (1889)
time	second	s	"... the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom." (1967)
electric current	ampere	A	"... that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per meter of length." (1946)
thermodynamic temperature	kelvin	K	"... the fraction 1/273.16 of the thermodynamic temperature of the triple point of water." (1967)
amount of substance	mole	mol	"... the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12." (1971)
luminous intensity	candela	cd	"... the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian." (1979)

Quantity	Name of Unit	Symbol	
area	square meter	m^2	
volume	cubic meter	m^3	
frequency	hertz	Hz	s^{-1}
mass density (density)	kilogram per cubic meter	kg/m^3	
speed, velocity	meter per second	m/s	
angular velocity	radian per second	rad/s	
acceleration	meter per second per second	m/s^2	
angular acceleration	radian per second per second	rad/s^2	
force	newton	N	$kg \cdot m/s^2$
pressure	pascal	Pa	N/m^2
work, energy, quantity of heat	joule	J	$N \cdot m$
power	watt	W	J/s
quantity of electric charge	coulomb	C	$A \cdot s$
potential difference, electromotive force	volt	V	W/A
electric field strength	volt per meter (or newton per coulomb)	V/m	N/C
electric resistance	ohm	Ω	V/A
capacitance	farad	F	$A \cdot s/V$
magnetic flux	weber	Wb	$V \cdot s$
inductance	henry	H	$V \cdot s/A$
magnetic flux density	tesla	T	Wb/m^2
magnetic field strength	ampere per meter	A/m	
entropy	joule per kelvin	J/K	
specific heat	joule per kilogram kelvin	$J/(kg \cdot K)$	
thermal conductivity	watt per meter kelvin	$W/(m \cdot K)$	
radiant intensity	watt per steradian	W/sr	

Some SI Derived Units

CONVERSION FACTORS

	cm	METER	km	in.	ft	mi
1 centimeter =	1	10^{-2}	10^{-5}	0.3937	3.281×10^{-2}	6.214×10^{-6}
1 METER =	100	1	10^{-3}	39.37	3.281	6.214×10^{-4}
1 kilometer =	10^5	1000	1	3.937×10^4	3281	0.6214
1 inch =	2.540	2.540×10^{-2}	2.540×10^{-5}	1	8.333×10^{-2}	1.578×10^{-5}
1 foot =	30.48	0.3048	3.048×10^{-4}	12	1	1.894×10^{-4}
1 mile =	1.609×10^5	1609	1.609	6.336×10^4	5280	1

1 angström = 10^{-10} m

1 nautical mile = 1852 m
= 1.151 miles = 6076 ft

1 fermi = 10^{-15} m

1 light-year = 9.461×10^{12} km

1 parsec = 3.084×10^{13} km

1 fathom = 6 ft

1 Bohr radius = 5.292×10^{-11} m

1 yard = 3 ft

1 rod = 16.5 ft

1 mil = 10^{-3} in.

1 nm = 10^{-9} m

	METER^2	cm^2	ft^2	in.^{2}
1 SQUARE METER =	1	10^4	10.76	1550
1 square centimeter =	10^{-4}	1	1.076×10^{-3}	0.1550
1 square foot =	9.290×10^{-2}	929.0	1	144
1 square inch =	6.452×10^{-4}	6.452	6.944×10^{-3}	1

1 square mile = 2.788×10^7 ft^2 = 640 acres

1 acre = 43 560 ft^2

1 barn = 10^{-28} m^2

1 hectare = 10^4 m^2 = 2.471 acres

	$METER^3$	cm^3	L	ft^3	$in.^3$
1 CUBIC METER = 1		10^6	1000	35.31	6.102×10^4
1 cubic centimeter = 10^{-6}		1	1.000×10^{-3}	3.531×10^{-5}	6.102×10^{-2}
1 liter = 1.000×10^{-3}		1000	1	3.531×10^{-2}	61.02
1 cubic foot = 2.832×10^{-2}		2.832×10^4	28.32	1	1728
1 cubic inch = 1.639×10^{-5}		16.39	1.639×10^{-2}	5.787×10^{-4}	1

1 U.S. fluid gallon = 4 U.S. fluid quarts = 8 U.S. pints = 128 U.S. fluid ounces = 231 $in.^3$

1 British imperial gallon = 277.4 $in.^3$ = 1.201 U.S. fluid gallons

Quantities in the colored areas are not mass units but are often used as such. For example, when we write 1 kg "=" 2.205 lb, this means that a kilogram is a *mass* that *weighs* 2.205 pounds at a location where g has the standard value of 9.80665 m/s^2.

	g	KILOGRAM	slug	u	oz	lb	ton
1 gram =	1	0.001	6.852×10^{-5}	6.022×10^{23}	3.527×10^{-2}	2.205×10^{-3}	1.102×10^{-6}
1 KILOGRAM =	1000	1	6.852×10^{-2}	6.022×10^{26}	35.27	2.205	1.102×10^{-3}
1 slug =	1.459×10^{4}	14.59	1	8.786×10^{27}	514.8	32.17	1.609×10^{-2}
1 atomic mass unit =	1.661×10^{-24}	1.661×10^{-27}	1.138×10^{-28}	1	5.857×10^{-26}	3.662×10^{-27}	1.830×10^{-30}
1 ounce =	28.35	2.835×10^{-2}	1.943×10^{-3}	1.718×10^{25}	1	6.250×10^{-2}	3.125×10^{-5}
1 pound =	453.6	0.4536	3.108×10^{-2}	2.732×10^{26}	16	1	0.0005
1 ton =	9.072×10^{5}	907.2	62.16	5.463×10^{29}	3.2×10^{4}	2000	1

1 metric ton = 1000 kg

	atm	dyne/cm^2	inch of water	cm Hg	PASCAL	lb/in.^{2}	lb/ft^2
1 atmosphere =	1	1.013×10^6	406.8	76	1.013×10^5	14.70	2116
1 dyne per centimeter^2 =	9.869×10^{-7}	1	4.015×10^{-4}	7.501×10^{-5}	0.1	1.405×10^{-5}	2.089×10^{-3}
1 inch of water[a] at 4°C =	2.458×10^{-3}	2491	1	0.1868	249.1	3.613×10^{-2}	5.202
1 centimeter of mercury[a] at 0°C =	1.316×10^{-2}	1.333×10^4	5.353	1	1333	0.1934	27.85
1 PASCAL =	9.869×10^{-6}	10	4.015×10^{-3}	7.501×10^{-4}	1	1.450×10^{-4}	2.089×10^{-2}
1 pound per inch^2 =	6.805×10^{-2}	6.895×10^4	27.68	5.171	6.895×10^3	1	144
1 pound per foot^2 =	4.725×10^{-4}	478.8	0.1922	3.591×10^{-2}	47.88	6.944×10^{-3}	1

[a]Where the acceleration of gravity has the standard value of 9.80665 m/s^2.

1 bar = 10^6 dyne/cm^2 = 0.1 MPa

1 millibar = 10^3 dyne/cm^2 = 10^2 Pa

1 torr = 1 mm Hg

Quantities in the colored areas are not energy units but are included for convenience. They arise from the relativistic mass–energy equivalence formula $E = mc^2$ and represent the energy released if a kilogram or unified atomic mass unit (u) is completely converted to energy (bottom two rows) or the mass that would be completely converted to one unit of energy (rightmost two columns).

	Btu	erg	ft·lb	hp·h	JOULE	cal	kW·h	eV	MeV	kg	u
1 British thermal unit =	1	1.055×10^{10}	777.9	3.929×10^{-4}	1055	252.0	2.930×10^{-4}	6.585×10^{21}	6.585×10^{15}	1.174×10^{-14}	7.070×10^{12}
1 erg =	9.481×10^{-11}	1	7.376×10^{-8}	3.725×10^{-14}	10^{-7}	2.389×10^{-8}	2.778×10^{-14}	6.242×10^{11}	6.242×10^{5}	1.113×10^{-24}	670.2
1 foot-pound =	1.285×10^{-3}	1.356×10^{7}	1	5.051×10^{-7}	1.356	0.3238	3.766×10^{-7}	8.464×10^{18}	8.464×10^{12}	1.509×10^{-17}	9.037×10^{9}
1 horsepower-hour =	2545	2.685×10^{13}	1.980×10^{6}	1	2.685×10^{6}	6.413×10^{5}	0.7457	1.676×10^{25}	1.676×10^{19}	2.988×10^{-11}	1.799×10^{16}
1 JOULE =	9.481×10^{-4}	10^{7}	0.7376	3.725×10^{-7}	1	0.2389	2.778×10^{-7}	6.242×10^{18}	6.242×10^{12}	1.113×10^{-17}	6.702×10^{9}
1 calorie =	3.968×10^{-3}	4.1868×10^{7}	3.088	1.560×10^{-6}	4.1868	1	1.163×10^{-6}	2.613×10^{19}	2.613×10^{13}	4.660×10^{-17}	2.806×10^{10}
1 kilowatt-hour =	3413	3.600×10^{13}	2.655×10^{6}	1.341	3.600×10^{6}	8.600×10^{5}	1	2.247×10^{25}	2.247×10^{19}	4.007×10^{-11}	2.413×10^{16}
1 electron-volt =	1.519×10^{-22}	1.602×10^{-12}	1.182×10^{-19}	5.967×10^{-26}	1.602×10^{-19}	3.827×10^{-20}	4.450×10^{-26}	1	10^{-6}	1.783×10^{-36}	1.074×10^{-9}
1 million electron-volts =	1.519×10^{-16}	1.602×10^{-6}	1.182×10^{-13}	5.967×10^{-20}	1.602×10^{-13}	3.827×10^{-14}	4.450×10^{-20}	10^{-6}	1	1.783×10^{-30}	1.074×10^{-3}
1 kilogram =	8.521×10^{13}	8.987×10^{23}	6.629×10^{16}	3.348×10^{10}	8.987×10^{16}	2.146×10^{16}	2.497×10^{10}	5.610×10^{35}	5.610×10^{29}	1	6.022×10^{26}
1 unified atomic mass unit =	1.415×10^{-13}	1.492×10^{-3}	1.101×10^{-10}	5.559×10^{-17}	1.492×10^{-10}	3.564×10^{-11}	4.146×10^{-17}	9.320×10^{8}	932.0	1.661×10^{-27}	1

	Btu/h	ft·lb/s	hp	cal/s	kW	WATT
1 British thermal unit per hour =	1	0.2161	3.929×10^{-4}	6.998×10^{-2}	2.930×10^{-4}	0.2930
1 foot-pound per second =	4.628	1	1.818×10^{-3}	0.3239	1.356×10^{-3}	1.356
1 horsepower =	2545	550	1	178.1	0.7457	745.7
1 calorie per second =	14.29	3.088	5.615×10^{-3}	1	4.186×10^{-3}	4.186
1 kilowatt =	3413	737.6	1.341	238.9	1	1000
1 WATT =	3.413	0.7376	1.341×10^{-3}	0.2389	0.001	1

Simbol Matematika

Symbol	Name	Read as	Meaning	Example
=	equality	equals, is equal to	If x=y, x and y represent the same value or thing.	2+3=5
≡	definition	is defined as	If x≡y, x is defined as another name of y	$(a+b)^2 \equiv a^2+2ab+b^2$
≈	approximately equal	is approximately equal to	If x≈y, x and y are almost equal.	√2≈1.41
≠	inequation	does not equal, is not equal to	If x≠y, x and y do not represent the same value or thing.	1+1≠3
<	strict inequality	is less than	If x<y, x is less than y.	4<5
>		is greater than	If x>y, x is greater than y.	3>2
≪		is much less than	If x≪y, x is much less than y.	1≪999999999
≫		is much greater than	If x≫y, x is much greater than y.	88979808≫0.001

Symbol	Name	Read as	Meaning	Example
≤	inequality	is less than or equal to	If x≤y, x is less than or equal to y.	5≤6 and 5≤5
≥		is greater than or equal to	If x≥y, x is greater than or equal to y.	2≥1 and 2≥2
∝	proportionality	is proportional to	If x∝y, then y=kx for some constant k.	If y=4x then y∝x and x∝y
+	addition	plus	x+y is the sum of x and y.	2+3=5
-	subtraction	minus	x-y is the subtraction of y from x	5-3=2
×	multiplication	times	x×y is the multiplication of x by y	4×5=20
·			x·y is the multiplication of x by y	4·5=20

Symbol	Name	Read as	Meaning	Example
÷	division	divided by	x÷y or x/y is the division of x by y	20÷4=5 and 20/4=5
/				20/4=5
±	plus-minus	plus or minus	x±y means both x+y and x-y	The equation 3±√9 has two solutions, 0 and 6.
∓	minus-plus	minus or plus	4±(3∓5) means both 4+(3-5) and 4-(3+5)	6∓(1±3)=2 or 4
√	square root	square root	√x is a number whose square is x.	√4=2 or -2
∑	summation	sum over … from … to … of, sigma	{\displaystyle \sum _{k=1}^{n}{x_{k}}} is the same as $x_1+x_2+x_3+x_k$	{\displaystyle \sum _{k=1}^{5}{k+2}=3+4 +5+6+7=25}
∏	multiplication	product over … from … to … of	{\displaystyle \prod _{k=1}^{n}{x_{k}}} is the same as $x_1 \times x_2 \times x_3 \times x_k$	{\displaystyle \prod _{k=1}^{5}{k}} =1×2×3×4×5=120

Symbol	Name	Read as	Meaning	Example
!	factorial	factorial	n! is the product 1×2×3...×n	5!=1×2×3×4×5=120
⇒	material implication	implies	A⇒B means that if A is true, B must also be true, but if A is false, B is unknown.	$x=3 \Rightarrow x^2=9$, but $x^2=9 \Rightarrow x=3$ is false, because x could also be -3.
⇔	material equivalence	if and only if	If A is true, B is true and if A is false, B is false.	x=y+1⇔x-1=y
|…|	absolute value	absolute value of	|x| is the distance along the real line (or across the complex plane) between x and zero	|5|=5 and |-5|=5
||	parallel	is parallel to	If A||B then A and B are parallel	
⊥	perpendicular	is perpendicular to	If A⊥B then A is perpendicular to B	
≅	congruence	is congruent to	If A≅B then shape A is congruent to shape B (has the same measurements)	

Symbol	Name	Read as	Meaning	Example
φ	golden ratio	golden ratio	The golden ratio is an irrational number equal to $(1+\sqrt{5})\div 2$ or approximately 1.6180339887.	
∞	infinity	infinity	∞ is a number greater than every real number.	
$\in$	set membership	is an element of	$a \in S$ means that a is an element of the set S	$3.5 \in \mathbb{R}$, $1 \in \mathbb{N}$, $1+i \in \mathbb{C}$
$\notin$		is not an element of	$a \notin S$ means that a is not an element of the set S	$2.1 \notin \mathbb{N}$, $1+i \notin \mathbb{R}$
{,}	Set brackets	the set of	{a,b,c} is the set consisting of a, b, and c	$\mathbb{N}$={0,1,2,3,4,5...}
$\mathbb{N}$	Natural numbers	N	$\mathbb{N}$ denotes the set of natural numbers {0,1,2,3,4,5...}	
$\mathbb{Z}$	Integers	Z	$\mathbb{Z}$ denotes the set of integers (-3,-2,-1,0,1,2,3...)	

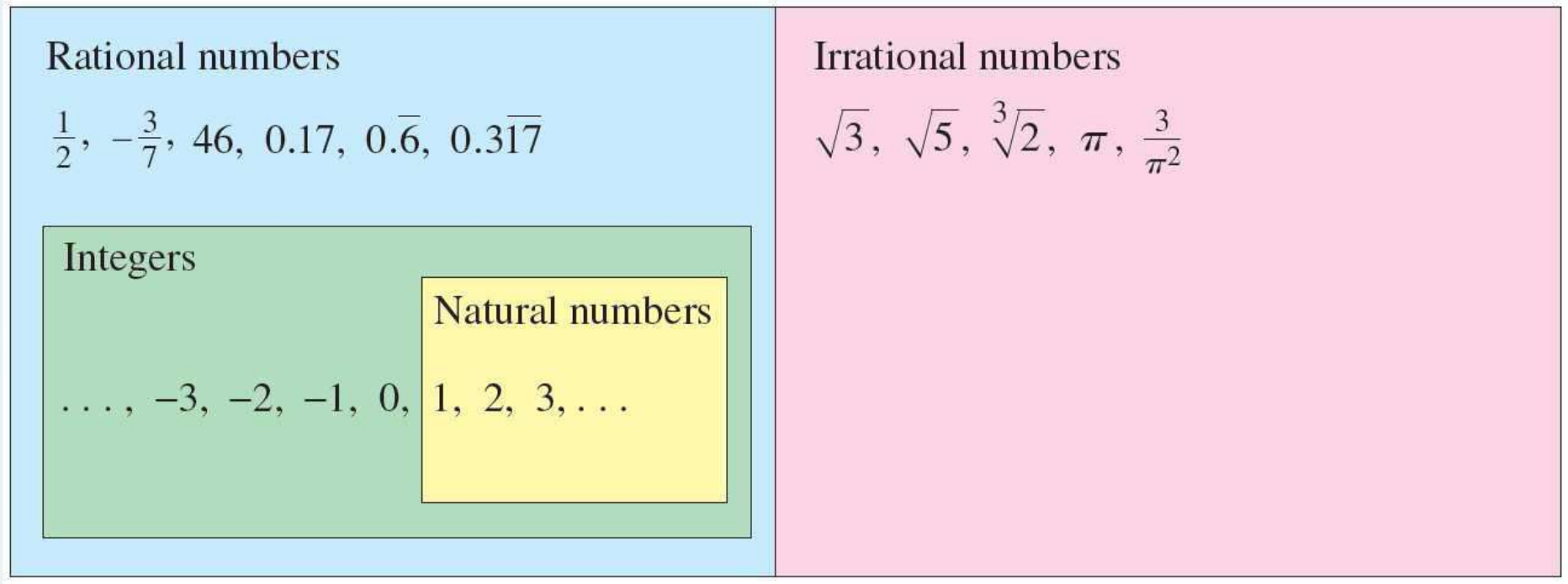
Symbol	Name	Read as	Meaning	Example
$\mathbb{Q}$	Rational numbers	Q	$\mathbb{Q}$ denotes the set of rational numbers (numbers that can be written as a fraction a/b where $a \in \mathbb{Z}$, $b \in \mathbb{N}$)	$8.323 \in \mathbb{Q}$, $7 \in \mathbb{Q}$, $\pi \notin \mathbb{Q}$
$\mathbb{R}$	Real numbers	R	$\mathbb{R}$ denotes the set of real numbers	$\pi \in \mathbb{R}$, $7 \in \mathbb{R}$, $\sqrt{(-1)} \notin \mathbb{R}$
$\mathbb{C}$	Complex numbers	C	$\mathbb{C}$ denotes the set of complex numbers	$\sqrt{(-1)} \in \mathbb{C}$
$\bar{x}$	Mean	bar, overbar	$\bar{x}$ is the mean (average) of x_i	if x={1,2,3} then $\bar{x}=2$
$\bar{x}$	complex conjugate	the complex conjugate of x	If $x=a + bi$, then $\bar{x}=a - bi$ where $i=\sqrt{(-1)}$	$x=-4 + 5.3i$, $\bar{x}=-4 - 5.3i$

Statistik yang cocok

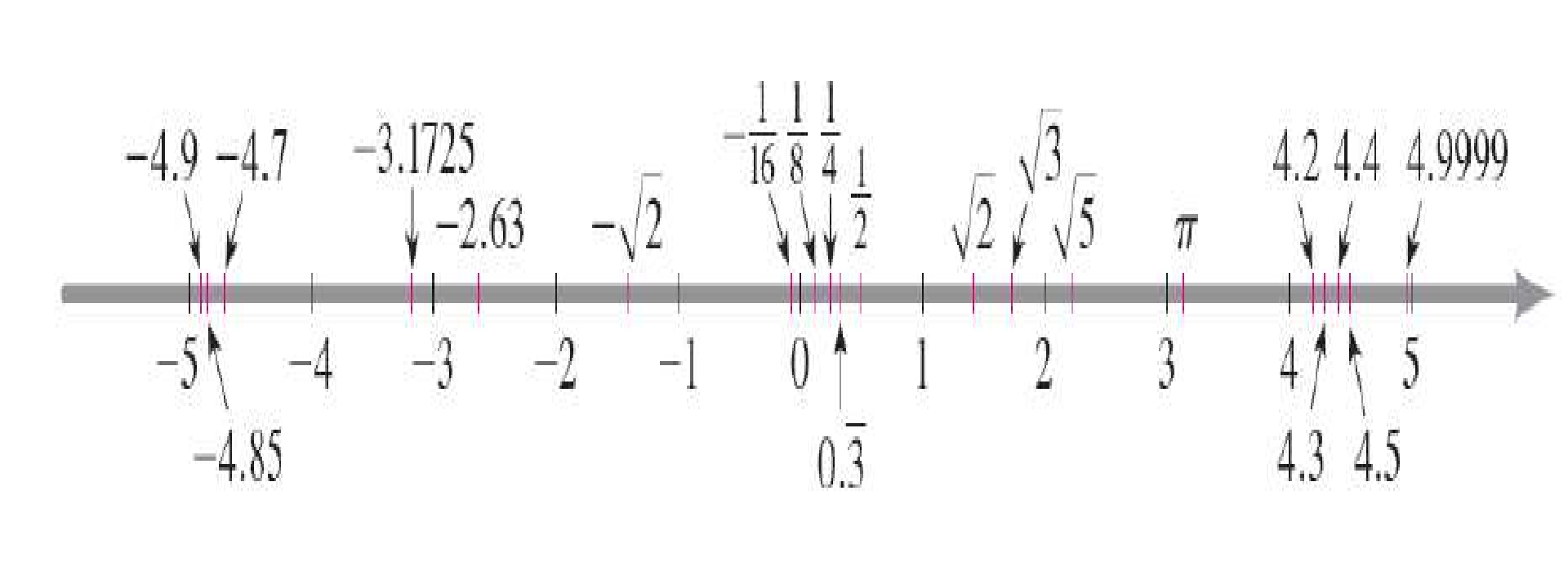
Jenis	Hubungan yang membatasi	Contoh statistik cocok	Tes yang sesuai
Nominal	- Ekuivalensi	- Modus - Frekuensi - Koef. Kontigensi	Non-parametrik
Ordinal	- Ekuivalensi - Lebih besar dari	- Median - Persentil - Spearmen - Kendall	Non-parametrik
Interval	- Ekuivalensi - Lebih besar dari - Rasio Sembarang 2 interval diketahui	- Median - Dev. standar - Korelasi Pearson - Korelasi hasil kali ganda	Non-parametrik dan Paramterik
Rasio	- Ekuivalensi - Lebih besar dari - Rasio Sembarang 2 interval diketahui - Rasio Sembarang 2 harga skala diketahui	- Geometrik mean - Koef. Variasi	Non-parametrik dan Paramterik

Penyegaran Klasifikasi Bilangan Ril (*Real Number*)

Sumber: "http://cims.nyu.edu/~kiryl/Precalculus/Section_1.1-Real_Numbers/Real_Numbers.pdf (Diakses 11 Februari 2015)



Garis Bilangan Real



Operasi Bilangan Real

PROPERTIES OF REAL NUMBERS

Property	Example	Description
Commutative Properties		
$a + b = b + a$	$7 + 3 = 3 + 7$	When we add two numbers, order doesn't matter.
$ab = ba$	$3 \cdot 5 = 5 \cdot 3$	When we multiply two numbers, order doesn't matter.
Associative Properties		
$(a + b) + c = a + (b + c)$	$(2 + 4) + 7 = 2 + (4 + 7)$	When we add three numbers, it doesn't matter which two we add first.
$(ab)c = a(bc)$	$(3 \cdot 7) \cdot 5 = 3 \cdot (7 \cdot 5)$	When we multiply three numbers, it doesn't matter which two we multiply first.
Distributive Property		
$a(b + c) = ab + ac$ $(b + c)a = ab + ac$	$2 \cdot (3 + 5) = 2 \cdot 3 + 2 \cdot 5$ $(3 + 5) \cdot 2 = 2 \cdot 3 + 2 \cdot 5$	When we multiply a number by a sum of two numbers, we get the same result as multiplying the number by each of the terms and then adding the results.

Properties of Zero

Let a and b be real numbers, variables, or algebraic expressions.

1. $a + 0 = a$ and $a - 0 = a$

2. $a \cdot 0 = 0$

3. $\frac{0}{a} = 0, \quad a \neq 0$

4. $\frac{a}{0}$ is undefined.

5. Zero-Factor Property: If $ab = 0$, then $a = 0$ or $b = 0$.

PROPERTIES OF NEGATIVES

Property	Example
1. $(-1)a = -a$	$(-1)5 = -5$
2. $-(-a) = a$	$-(-5) = 5$
3. $(-a)b = a(-b) = -(ab)$	$(-5)7 = 5(-7) = -(5 \cdot 7)$
4. $(-a)(-b) = ab$	$(-4)(-3) = 4 \cdot 3$
5. $-(a + b) = -a - b$	$-(3 + 5) = -3 - 5$
6. $-(a - b) = b - a$	$-(5 - 8) = 8 - 5$

PROPERTIES OF FRACTIONS

Property	Example	Description
1. $\frac{a}{b}\cdot\frac{c}{d}=\frac{ac}{bd}$	$\frac{2}{3}\cdot\frac{5}{7}=\frac{2\cdot5}{3\cdot7}=\frac{10}{21}$	When **multiplying fractions**, multiply numerators and denominators.
2. $\frac{a}{b}\div\frac{c}{d}=\frac{a}{b}\cdot\frac{d}{c}$	$\frac{2}{3}\div\frac{5}{7}=\frac{2}{3}\cdot\frac{7}{5}=\frac{14}{15}$	When **dividing fractions**, invert the divisor and multiply.
3. $\frac{a}{c}+\frac{b}{c}=\frac{a+b}{c}$	$\frac{2}{5}+\frac{7}{5}=\frac{2+7}{5}=\frac{9}{5}$	When **adding fractions** with the **same denominator**, add the numerators.
4. $\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$	$\frac{2}{5}+\frac{3}{7}=\frac{2\cdot7+3\cdot5}{35}=\frac{29}{35}$	When **adding fractions** with **different denominators**, find a common denominator. Then add the numerators.
5. $\frac{ac}{bc}=\frac{a}{b}$	$\frac{2\cdot5}{3\cdot5}=\frac{2}{3}$	**Cancel** numbers that are **common factors** in the numerator and denominator.
6. If $\frac{a}{b}=\frac{c}{d}$, then $ad=bc$	$\frac{2}{3}=\frac{6}{9}$, so $2\cdot9=3\cdot6$	**Cross multiply.**

Notation	Set description	Graph
(a, b)	$\{x \mid a < x < b\}$	
$[a, b]$	$\{x \mid a \leq x \leq b\}$	
$[a, b)$	$\{x \mid a \leq x < b\}$	
$(a, b]$	$\{x \mid a < x \leq b\}$	
(a, ∞)	$\{x \mid a < x\}$	
$[a, \infty)$	$\{x \mid a \leq x\}$	
$(-\infty, b)$	$\{x \mid x < b\}$	
$(-\infty, b]$	$\{x \mid x \leq b\}$	
$(-\infty, \infty)$	$\mathbb{R}$ (set of all real numbers)	

DEFINITION OF ABSOLUTE VALUE

If a is a real number, then the **absolute value** of a is

$$|a| = \begin{cases} a & \text{if } a \geq 0 \\ -a & \text{if } a < 0 \end{cases}$$

PROPERTIES OF ABSOLUTE VALUE

Property	Example	Description
1. $\lvert a\rvert \geq 0$	$\lvert -3\rvert = 3 \geq 0$	The absolute value of a number is always positive or zero.
2. $\lvert a\rvert = \lvert -a\rvert$	$\lvert 5\rvert = \lvert -5\rvert$	A number and its negative have the same absolute value.
3. $\lvert ab\rvert = \lvert a\rvert\,\lvert b\rvert$	$\lvert -2 \cdot 5\rvert = \lvert -2\rvert\,\lvert 5\rvert$	The absolute value of a product is the product of the absolute values.
4. $\left\lvert \frac{a}{b} \right\rvert = \frac{\lvert a\rvert}{\lvert b\rvert}$	$\left\lvert \frac{12}{-3} \right\rvert = \frac{\lvert 12\rvert}{\lvert -3\rvert}$	The absolute value of a quotient is the quotient of the absolute values.

DISTANCE BETWEEN POINTS ON THE REAL LINE

If a and b are real numbers, then the **distance** between the points a and b on the real line is

$$d(a, b) = |b - a|$$

NOTASI SUMASI:

Sumber : "http://faculty.arts.ubc.ca/hkasahara/Econ325/notes.pdf
"Properties of Summation Operator (Diakses 11 Februari 2015)

$$x_1 + x_2 + \ldots + x_n = \sum_{i=1}^{n} x_i.$$

$$\sum_{i=1}^{n} cx_i = cx_1 + cx_2 + \ldots + cx_n$$

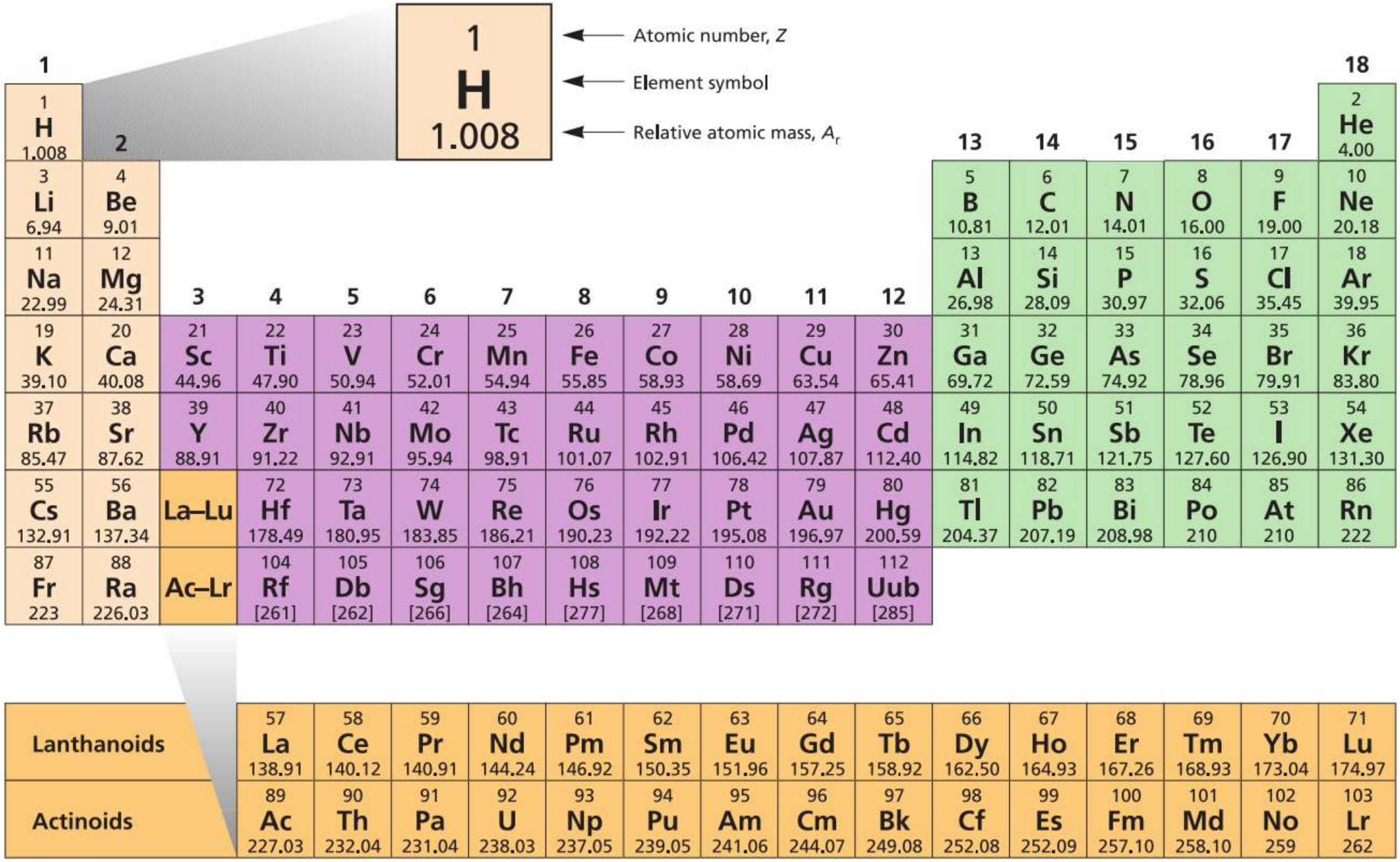
$$= c \times (x_1 + x_2 + \ldots + x_n) = c \sum_{i=1}^{n} x_i.$$

$$\sum_{i=1}^{n}\sum_{j=1}^{m} x_i y_j = \sum_{i=1}^{n} x_i \sum_{j=1}^{m} y_j$$

$$= \sum_{j=1}^{m} y_j \sum_{i=1}^{n} x_i .$$

Sumber:
Housecroft, C.E. and E. C. Constable . 2006. CHEMISTRY: An Introduction to Organic, Inorganic and Physical Chemistry. Pear. son Education Limited, Edinburgh Gate, Harlow Essex CM20 2JE. England

Periodic table



1												13	14	15	16	17	18
1 H 1.008	2																2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3	4	5	6	7	8	9	10	11	12	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.01	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.54	30 Zn 65.41	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.91	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98.91	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30
55 Cs 132.91	56 Ba 137.34	La–Lu	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.98	84 Po 210	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226.03	Ac–Lr	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [277]	109 Mt [268]	110 Ds [271]	111 Rg [272]	112 Uub [285]						

Lanthanoids	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 146.92	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
Actinoids	89 Ac 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 239.05	95 Am 241.06	96 Cm 244.07	97 Bk 249.08	98 Cf 252.08	99 Es 252.09	100 Fm 257.10	101 Md 258.10	102 No 259	103 Lr 262

The base quantities of the SI system

Physical quantity	Symbol for quantity	Base unit	Unit symbol
Mass	m	kilogram	kg
Length	l	metre	m
Time	t	second	s
Electrical current	I	ampere	A
Temperature (thermodynamic)	T	kelvin	K
Amount of substance	n	mole	mol
Luminous intensity	I_v	candela	cd

Some derived units of the SI system with particular names

Unit	Name of unit	Symbol	Relation to base units
Energy	joule	J	$\mathrm{kg\,m^2\,s^{-2}}$
Frequency	hertz	Hz	$\mathrm{s^{-1}}$
Force	newton	N	$\mathrm{kg\,m\,s^{-2}}$
Pressure	pascal	Pa	$\mathrm{kg\,m^{-1}\,s^{-2}}$
Electric charge	coulomb	C	$\mathrm{A\,s}$
Capacitance	farad	F	$\mathrm{A^2\,s^4\,kg^{-1}\,m^{-2}}$
Electromotive force (emf)	volt	V	$\mathrm{kg\,m^2\,s^{-3}\,A^{-1}}$
Resistance	ohm	Ω	$\mathrm{kg\,m^2\,s^{-3}\,A^{-2}}$

$$\text{Volume of box} = \text{length} \times \text{width} \times \text{height} = a \times b \times c = abc$$

$$\begin{aligned}\text{SI unit of volume} &= (\text{SI unit of length}) \times (\text{SI unit of width}) \\ &\quad \times (\text{SI unit of height}) \\ &= \text{m} \times \text{m} \times \text{m} = \text{m}^3\end{aligned}$$

$$\begin{aligned}\text{Volume of box} &= (\text{length in m}) \times (\text{width in m}) \times (\text{height in m}) \\ &= (a\,\text{m}) \times (b\,\text{m}) \times (c\,\text{m}) \\ &= abc\,\text{m}^3\end{aligned}$$

Density is mass per unit volume:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\therefore \text{ the SI unit of density} = \frac{\text{SI unit of mass}}{\text{SI unit of volume}} = \frac{\text{kg}}{\text{m}^3} = \text{kg}\,\text{m}^{-3}$$

- The SI unit of ‘amount of substance’ is the mole.
- This unit can apply to any substance and hence it is usual to find the statement ‘a mole of x’ where x might be electrons, atoms or molecules.
- In one mole of substance there are $\approx 6.022\ x\ 10^{23}$ particles, and this number is called the Avogadro constant or number, L. It is defined as the number of atoms of carbon in exactly 12 g of a sample of isotopically pure ${}^{12}_{6}C$. Since L is the number of particles in a mole of substance, its units are mol^{-1}.

mass number → $^{A}_{Z}\mathrm{E}$

element symbol →

atomic number →

e.g. $^{59}_{27}\mathrm{Co}$

Atomic number = Z = number of protons in the nucleus = number of electrons

Mass number = A = number of protons + number of neutrons

Calculate how many atoms there are in 0.200 moles of copper. ($L = 6.022 \times 10^{23}\,\text{mol}^{-1}$)

The number of atoms in one mole of Cu is equal to the Avogadro constant $= 6.022 \times 10^{23}$.

$$\text{Number of atoms in 0.200 moles of Cu} = (0.200\,\text{mol}) \times (6.022 \times 10^{23}\,\text{mol}^{-1})$$

$$= 1.20 \times 10^{23} \quad \text{(to 3 sig. fig.)}$$

The mole and the Avogadro constant (2)

Calculate how many molecules of H_2O there are in 12.10 moles of water. ($L = 6.022 \times 10^{23}\,mol^{-1}$)

The number of molecules in one mole of water is equal to the Avogadro constant $= 6.022 \times 10^{23}$.

Number of molecules in

$$12.10 \text{ moles of water} = (12.10\,mol) \times (6.022 \times 10^{23}\,mol^{-1})$$

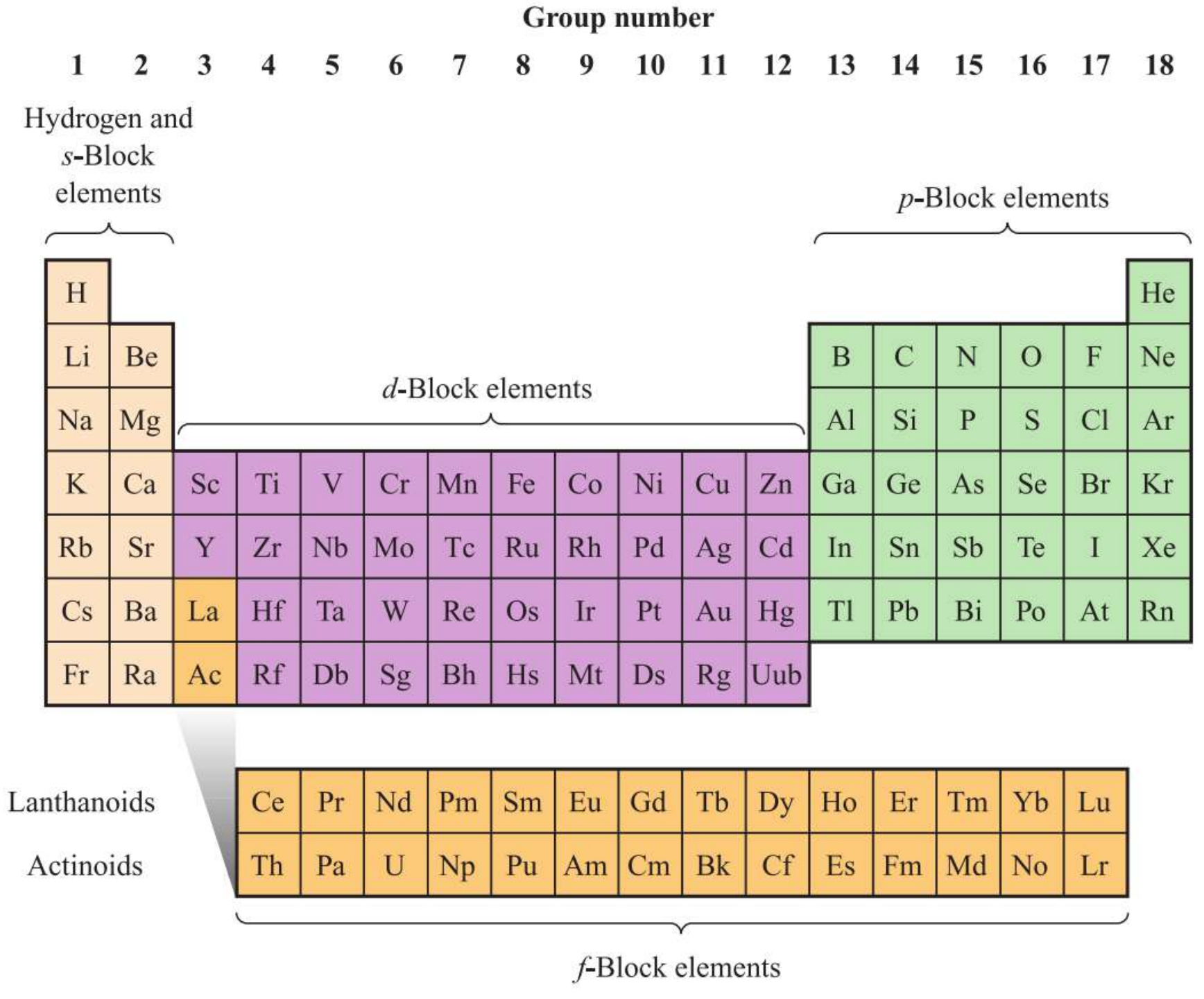
$$= 7.287 \times 10^{24} \quad \text{(to 4 sig. fig.)}$$

Calculate the relative atomic mass A_r of naturally occurring magnesium if the distribution of isotopes is 78.7% $^{24}_{12}Mg$, 10.1% $^{25}_{12}Mg$ and 11.2% $^{26}_{12}Mg$, and the accurate masses of the isotopes to three significant figures (sig. fig.) are 24.0, 25.0 and 26.0.

The relative atomic mass of magnesium is the weighted mean of the atomic masses of the three isotopes:

$$\text{Relative atomic mass} = \left(\frac{78.7}{100} \times 24.0\right) + \left(\frac{10.1}{100} \times 25.0\right) + \left(\frac{11.2}{100} \times 26.0\right)$$

$$= 24.3 \quad \text{(to 3 sig. fig.)}$$


Group number
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Hydrogen and s-Block elements
p-Block elements
d-Block elements
H He
Li Be B C N O F Ne
Na Mg Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba La Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
Fr Ra Ac Rf Db Sg Bh Hs Mt Ds Rg Uub
Lanthanoids Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
Actinoids Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr
f-Block elements

Group number	Recommended name
1 (except H)	Alkali metals
2	Alkaline earth metals
15	Pnictogens
16	Chalcogens
17	Halogens
18	Noble gases
1 (except H), 2, 13, 14, 15, 16, 17, 18	Main group elements

DATA DAN VARIABEL

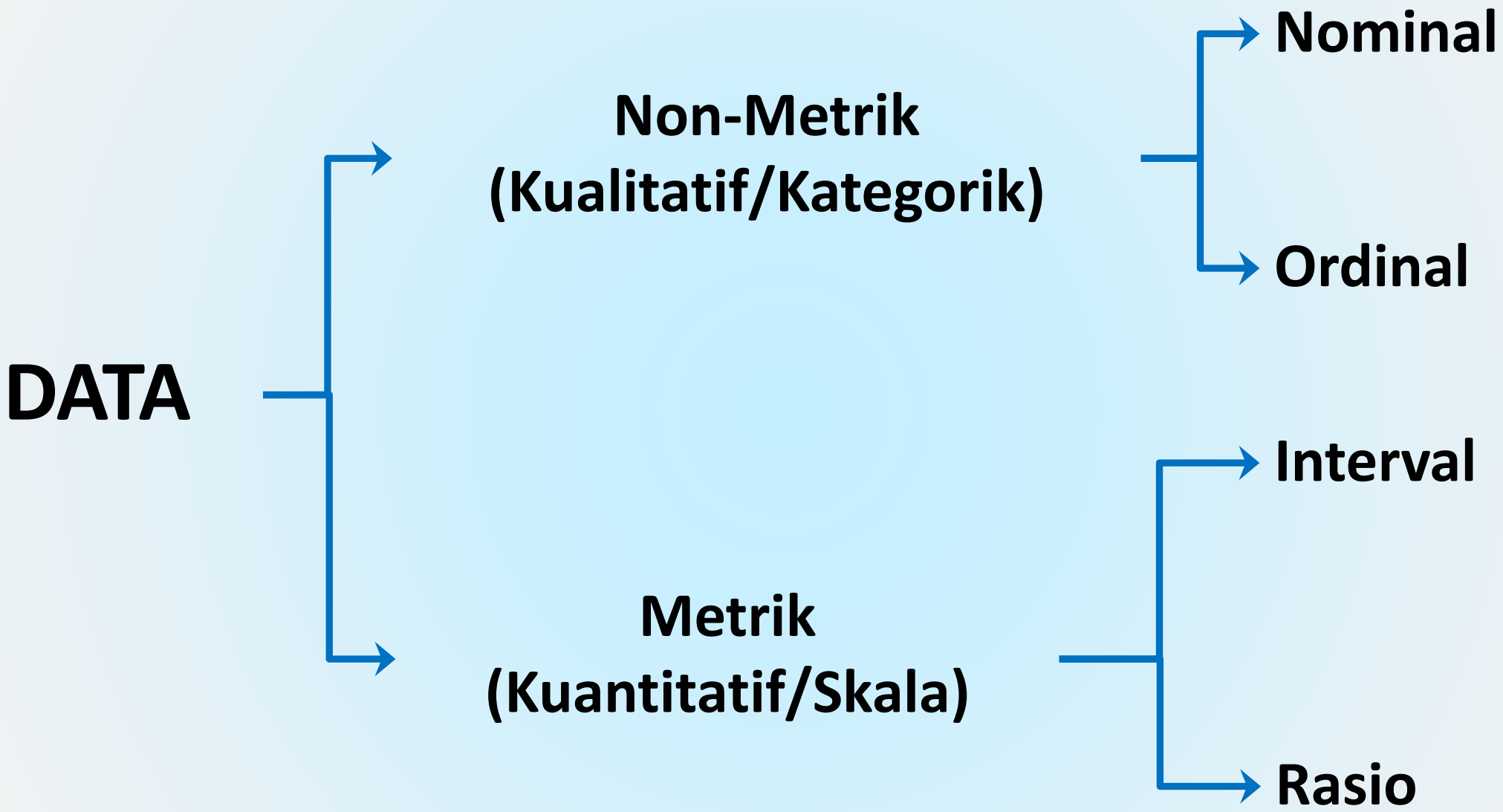
Data merupakan kumpulan nilai.
Karena itu bermakna “jamak”
Jika tunggal = “datum”
Nilai dari data diperoleh dari mengukur karakteristik tertentu dari objek penelitian.
Misal: Panjang ikan, bobot, ikan, dll.

- Variabel, memiliki akar kata “*vary*”, yaitu bermakna “beragam”.
- Karakteristik tertentu dari objek yang diukur dapat merupakan “variabel”.
- Variabel haruslah bervariasi (beragam, berbeda).
- Jika suatu karakteristik adalah sama maka bukan merupakan variabel.
- Contoh: “Jenis ikan” di dalam suatu akuarium yang hanya berisi lele; maka akan didapatkan jenis ikan-nya hanya satu yaitu “lele”. Jadi dalam hal ini “Jenis ikan “ bukanlah variabel, melainkan hanya data.
- Lain halnya untuk jenis ikan di Sungai Tulang Bawang, maka akan banyak jenis, jadi bersifat “variabel”

- Variabel, bagaikan wadah untuk menampung data dengan karakteristik yang sama.
- Misal variabel dengan nama “Jenis Ikan”, “ Panjang Ikan”, dst
- Jadi data mengenai jenis ikan ditampung dalam variabel “Jenis ikan “, dst.

Jenis Data:

- Menurut cara mendapatkan: Primer, sekunder.
- Menurut karakteristik skala: diskret dan kontinyu.
- Menurut karakteristik nilai: metrik dan non metrik.
- Menurut skala pengukuran: nominal, Ordinal, Interval, Rasio


DATA
Non-Metrik
(Kualitatif/Kategorik)
Nominal
Ordinal
Metrik
(Kuantitatif/Skala)
Interval
Rasio

Data Nominal:

- Diukur dengan skala nominal
- Hanya dituntut memiliki unsur pembeda, tanpa perlu diketahui urutan dan sebesar apa perbedaan tersebut.
- Misal: jenis kelamin, hanya dibedakan laki-laki dan perempuan; tidak perlu diketahui urutan (lebih besar, penting, dll), dan besar perbedaan tersebut.

Data Ordinal:

- Diukur dengan skala ordinal, memperhatikan urutan atau orde antar nilainya.
- Memiliki unsur pembeda (seperti nominal), dan juga berbeda orde.
- Misal: Tingkat pendidikan dikode, SD (1), SMP (2), SMA (3), maka dapat dibuat hubungan 1 < 2 < 3; namun tidak bisa 2-1 atau 3-2.

Data Interval:

- Diukur dengan skala interval, memperhatikan jarak, selisih antar nilainya.
- Memiliki sifat nominal dan ordinal.
- Misal: Tahun lahir 2000, 2010, 2014, dapat dibuat urutan tua muda 2000 > 2010 > 2014; Juga selisih 2000 dan 2010 adalah 10 tahun, dst; namun perbandingan 2010/2000 tidak bermakna.

Data Interval:

- Nilai data menunjukkan posisinya pada skala ukur.
- Pada skala interval, nilai 0 bukanlah nilai natural. Misal suhu 0 ºC, **tidak** berarti tidak ada panas. Tahun 0 bukan berarti waktu belum berjalan.

Contoh lain data Interval:

- Suhu yang diukur dengan skala celcius, Kalvin, Fahrenheit.
- Prestasi yang diukur dengan indeks prestasi (IP).
- Dapat dilakukan operasi matematika terbatas seperti penjumlhan dan pengurangan.
- Selisih 50 ºC dan 90 ºC adalah 40 Cº; dan 30 ºC dan 50 ºC adalah 20 Cº

Contoh lain data Interval:

- Operasi matematika lanjut seperti perkalian dan pembagian yang dapat dilakukan hanya pada selisih dua interval.
- Dari contoh Selisih 50 ºC dan 90 ºC adalah 40 Cº; dan 30 ºC dan 50 ºC adalah 20 Cº.
- Dari dua selisih di atas: 40 Cº / 20 Cº = 2 kali lipat.

Penjelasan lain data Interval:

- Benda bersuhu 60 ºC **tidak bisa** dikatakan 3 kali lebih panas daripada benda bersuhu 20 ºC. Yang dapat dikatakan hanyalah bahwa benda yang bersuhu 60 ºC lebih panas daripada yang bersuhu 20 ºC.
- Mahasiswa ber-IP 3 **tidak bisa** dikatakan 2 kali lebih pintar daripada yang ber-IP 1,5 ???
- Apakah orang yang lahir tahun 2000 berarti 2 kali lebih tua (muda) daripada yang lahir tahun 1000 ???

Data Rasio:

- Diukur dengan skala rasional.
- Nilai data harus dapat dibandingkan dengan nilai data yang lain.
- Memenuhi syarat sebagai data nominal, ordinal, dan interval.
- Nilai 0 pada data rasio bermakna bahwa nilai tersebut memang **tidak ada**.
- Umumnya data yang diperbincangkan pada Prodi BDPi adalah rasio.

Contoh Data Rasio:

- Bobot ikan A 6 kg dan B 2 kg.
- Jelas A > B
- Selisih A – B = 4 kg
- A adalah 3 kali lebih berat dari B.
- Dapat dilakukan operasi matematika penjumlahan, pengurangan, perkalian, pembagian, pangkat, dst.

Kaitan antara Jenis Data

Jenis	Kategorik	Orde	Perbedaan	Perbandingan
Nominal	√			
Ordinal	√	√		
Interval	√	√	√	
Rasio	√	√	√	√

Hipotesis: pernyataan yang dibuat berdasarkan pada fenomena, teori, dan informasi ilmiah lain yang telah ada sebelumnya.

Hipotesis penelitian: dugaan sementara yang masih memerlukan pengujian.

- Contoh: “keuntungan usaha lele lebih besar daripada usaha gurame”.
- Dalam statistika dilambangkan H_1

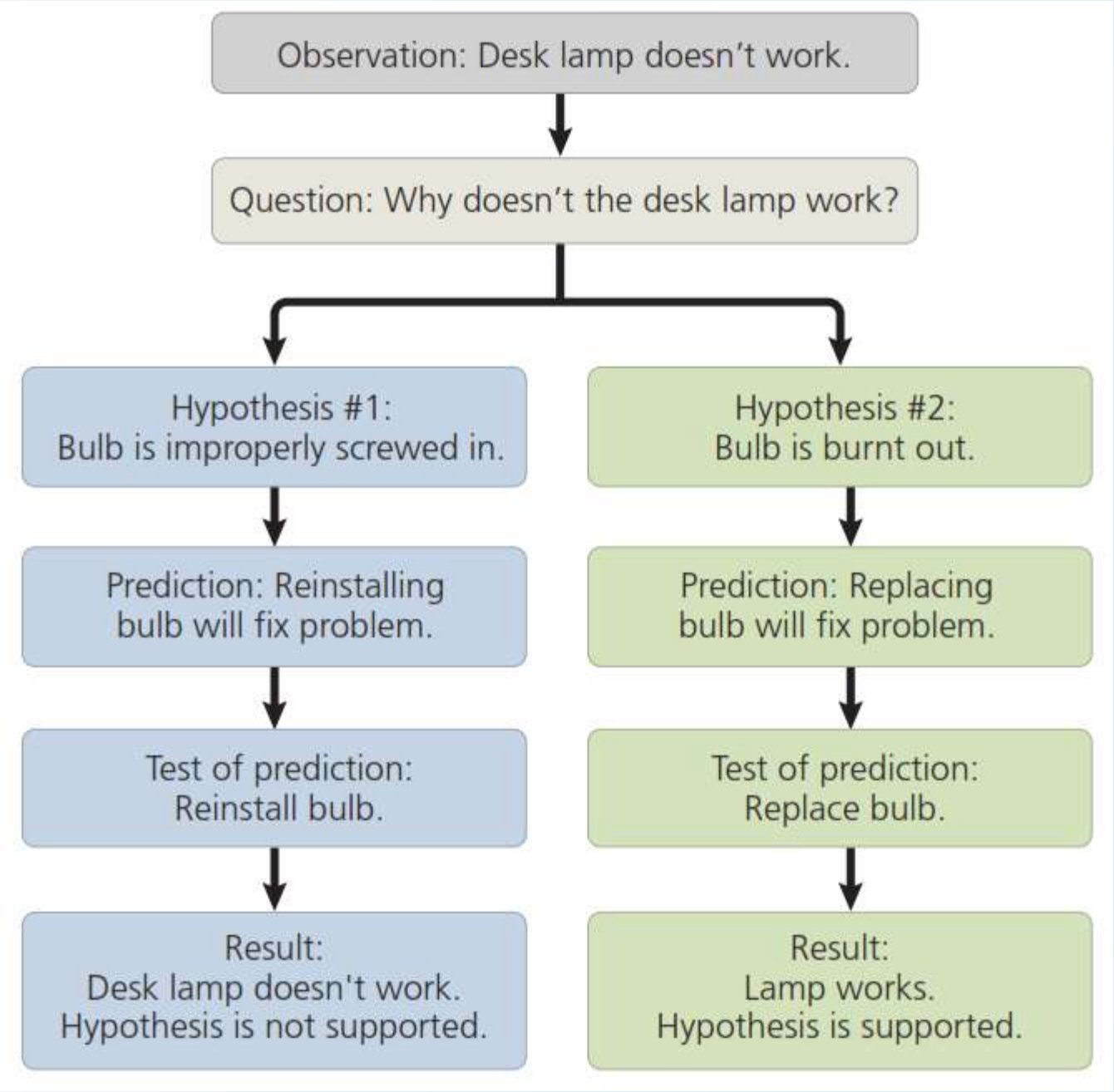
Hipotesis nol: pernyataan yang menolak hipotesis penelitian.

- Contoh (**Teladan**):
- “keuntungan usaha lele adalah sama dengan usaha gurame”. dan/atau:
- “keuntungan usaha lele lebih kecil daripada usaha gurame”.
- Dalam statistika dilambangkan H_0

Hipotesis statistik: pernyataan mengenai parameter populasi yang didasarkan pada statistik sampel.

- Contoh dari lele dan gurame, misalkan lele dilambangkan "l" dan gurame "g", maka:
  - $H_0 : \mu_l \leq \mu_g$
  - $H_1 : \mu_l > \mu_g$

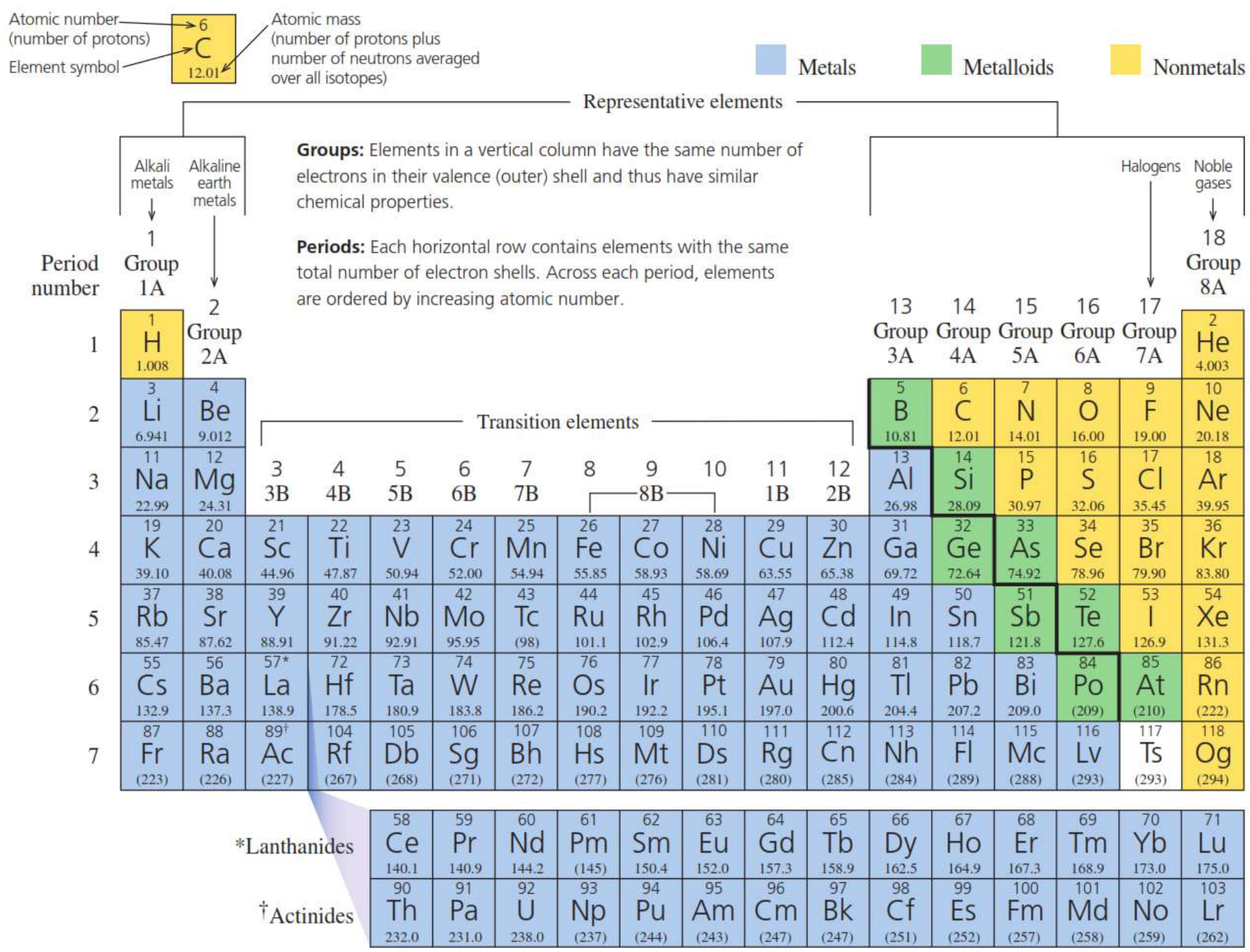
Hipotesis statistik harus diuji agar dapat disimpulkan "ditolak" atau "diterima".



A simplified view of the scientific process

The idealized process sometimes called the "scientific method" is shown in this flow chart, which illustrates hypothesis testing for a desk lamp that doesn't work.

Sumber:
U., Lisa, M. Cain, S. Wasserman, P. Minorsky, J. Reece. 2017. *Campbell biology*. Pearson Education, Inc.


Atomic number (number of protons)
Element symbol
6
C
12.01
Atomic mass (number of protons plus number of neutrons averaged over all isotopes)
Metals
Metalloids
Nonmetals
Representative elements
Alkali metals
Alkaline earth metals
Halogens
Noble gases
Groups: Elements in a vertical column have the same number of electrons in their valence (outer) shell and thus have similar chemical properties.
Periods: Each horizontal row contains elements with the same total number of electron shells. Across each period, elements are ordered by increasing atomic number.
Period number
Group 1A
Group 2A
Group 3A
Group 4A
Group 5A
Group 6A
Group 7A
Group 8A
Transition elements
3B
4B
5B
6B
7B
8B
1B
2B
1 H 1.008
2 He 4.003
3 Li 6.941
4 Be 9.012
5 B 10.81
6 C 12.01
7 N 14.01
8 O 16.00
9 F 19.00
10 Ne 20.18
11 Na 22.99
12 Mg 24.31
13 Al 26.98
14 Si 28.09
15 P 30.97
16 S 32.06
17 Cl 35.45
18 Ar 39.95
19 K 39.10
20 Ca 40.08
21 Sc 44.96
22 Ti 47.87
23 V 50.94
24 Cr 52.00
25 Mn 54.94
26 Fe 55.85
27 Co 58.93
28 Ni 58.69
29 Cu 63.55
30 Zn 65.38
31 Ga 69.72
32 Ge 72.64
33 As 74.92
34 Se 78.96
35 Br 79.90
36 Kr 83.80
37 Rb 85.47
38 Sr 87.62
39 Y 88.91
40 Zr 91.22
41 Nb 92.91
42 Mo 95.95
43 Tc (98)
44 Ru 101.1
45 Rh 102.9
46 Pd 106.4
47 Ag 107.9
48 Cd 112.4
49 In 114.8
50 Sn 118.7
51 Sb 121.8
52 Te 127.6
53 I 126.9
54 Xe 131.3
55 Cs 132.9
56 Ba 137.3
57* La 138.9
72 Hf 178.5
73 Ta 180.9
74 W 183.8
75 Re 186.2
76 Os 190.2
77 Ir 192.2
78 Pt 195.1
79 Au 197.0
80 Hg 200.6
81 Tl 204.4
82 Pb 207.2
83 Bi 209.0
84 Po (209)
85 At (210)
86 Rn (222)
87 Fr (223)
88 Ra (226)
89† Ac (227)
104 Rf (267)
105 Db (268)
106 Sg (271)
107 Bh (272)
108 Hs (277)
109 Mt (276)
110 Ds (281)
111 Rg (280)
112 Cn (285)
113 Nh (284)
114 Fl (289)
115 Mc (288)
116 Lv (293)
117 Ts (293)
118 Og (294)
*Lanthanides
58 Ce 140.1
59 Pr 140.9
60 Nd 144.2
61 Pm (145)
62 Sm 150.4
63 Eu 152.0
64 Gd 157.3
65 Tb 158.9
66 Dy 162.5
67 Ho 164.9
68 Er 167.3
69 Tm 168.9
70 Yb 173.0
71 Lu 175.0
†Actinides
90 Th 232.0
91 Pa 231.0
92 U 238.0
93 Np (237)
94 Pu (244)
95 Am (243)
96 Cm (247)
97 Bk (247)
98 Cf (251)
99 Es (252)
100 Fm (257)
101 Md (258)
102 No (259)
103 Lr (262)

Name (Symbol)	Atomic Number	Name (Symbol)	Atomic Number	Name (Symbol)	Atomic Number	Name (Symbol)	Atomic Number	Name (Symbol)	Atomic Number
Actinium (Ac)	89	Copper (Cu)	29	Iron (Fe)	26	Osmium (Os)	76	Silicon (Si)	14
Aluminum (Al)	13	Curium (Cm)	96	Krypton (Kr)	36	Oxygen (O)	8	Silver (Ag)	47
Americium (Am)	95	Darmstadtium (Ds)	110	Lanthanum (La)	57	Palladium (Pd)	46	Sodium (Na)	11
Antimony (Sb)	51	Dubnium (Db)	105	Lawrencium (Lr)	103	Phosphorus (P)	15	Strontium (Sr)	38
Argon (Ar)	18	Dysprosium (Dy)	66	Lead (Pb)	82	Platinum (Pt)	78	Sulfur (S)	16
Arsenic (As)	33	Einsteinium (Es)	99	Lithium (Li)	3	Plutonium (Pu)	94	Tantalum (Ta)	73
Astatine (At)	85	Erbium (Er)	68	Livermorium (Lv)	116	Polonium (Po)	84	Technetium (Tc)	43
Barium (Ba)	56	Europium (Eu)	63	Lutetium (Lu)	71	Potassium (K)	19	Tellurium (Te)	52
Berkelium (Bk)	97	Fermium (Fm)	100	Magnesium (Mg)	12	Praseod`ymium (Pr)	59	Tennessine (Ts)	117
Beryllium (Be)	4	Flerovium (Fl)	114	Manganese (Mn)	25	Promethium (Pm)	61	Terbium (Tb)	65
Bismuth (Bi)	83	Fluorine (F)	9	Meitnerium (Mt)	109	Protactinium (Pa)	91	Thallium (Tl)	81
Bohrium (Bh)	107	Francium (Fr)	87	Mendelevium (Md)	101	Radium (Ra)	88	Thorium (Th)	90
Boron (B)	5	Gadolinium (Gd)	64	Mercury (Hg)	80	Radon (Rn)	86	Thulium (Tm)	69
Bromine (Br)	35	Gallium (Ga)	31	Molybdenum (Mo)	42	Rhenium (Re)	75	Tin (Sn)	50
Cadmium (Cd)	48	Germanium (Ge)	32	Moscovium (Mc)	115	Rhodium (Rh)	45	Titanium (Ti)	22
Calcium (Ca)	20	Gold (Au)	79	Neodymium (Nd)	60	Roentgenium (Rg)	111	Tungsten (W)	74
Californium (Cf)	98	Hafnium (Hf)	72	Neon (Ne)	10	Rubidium (Rb)	37	Uranium (U)	92
Carbon (C)	6	Hassium (Hs)	108	Neptunium (Np)	93	Ruthenium (Ru)	44	Vanadium (V)	23
Cerium (Ce)	58	Helium (He)	2	Nickel (Ni)	28	Rutherfordium (Rf)	104	Xenon (Xe)	54
Cesium (Cs)	55	Holmium (Ho)	67	Nihonium (Nh)	113	Samarium (Sm)	62	Ytterbium (Yb)	70
Chlorine (Cl)	17	Hydrogen (H)	1	Niobium (Nb)	41	Scandium (Sc)	21	Yttrium (Y)	39
Chromium (Cr)	24	Indium (In)	49	Nitrogen (N)	7	Seaborgium (Sg)	106	Zinc (Zn)	30
Cobalt (Co)	27	Iodine (I)	53	Nobelium (No)	102	Selenium (Se)	34	Zirconium (Zr)	40
Copernicium (Cn)	112	Iridium (Ir)	77	Oganesson (Og)	118				

Terima Kasih