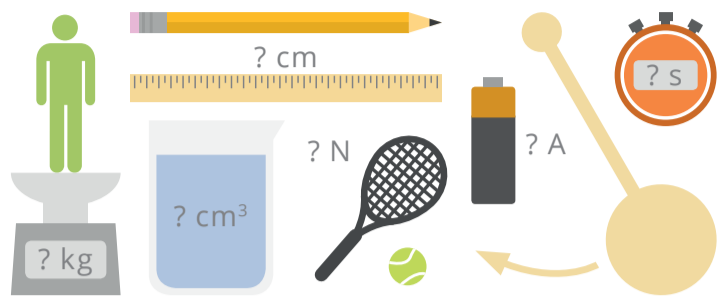

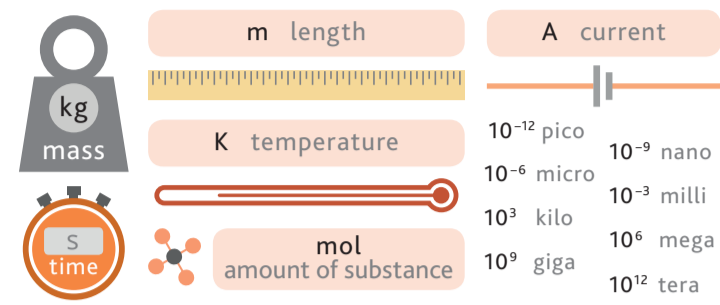



1

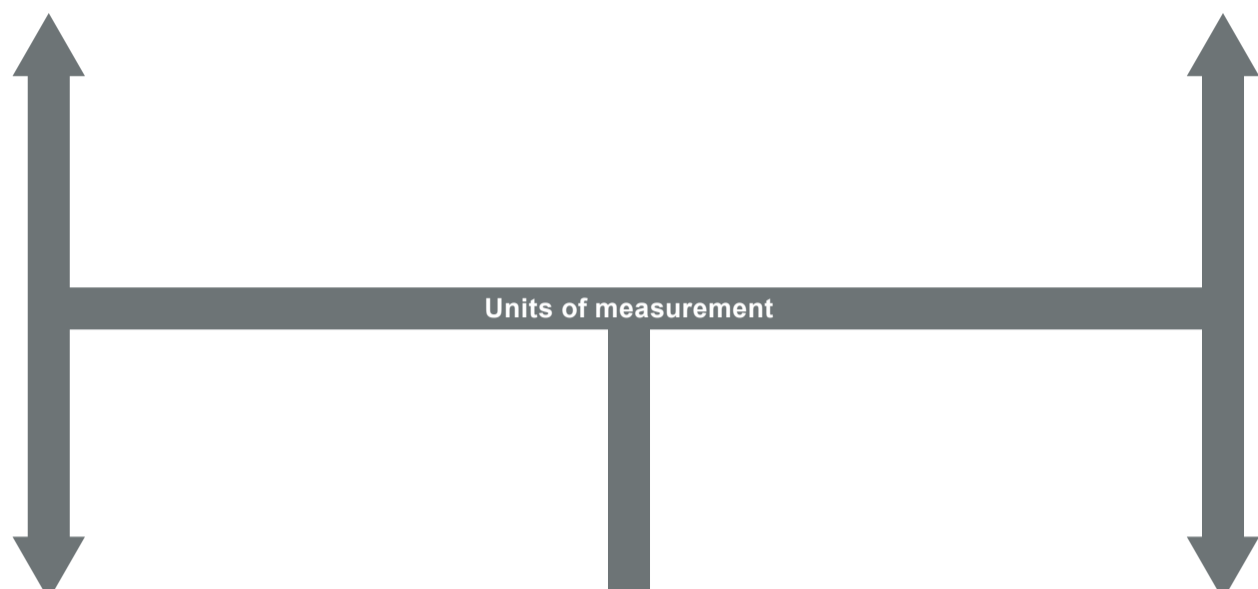
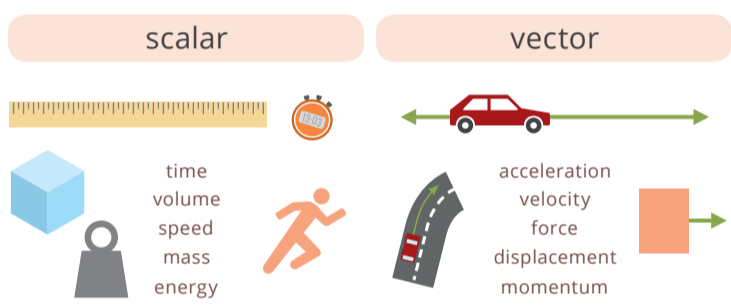
Skills for physics




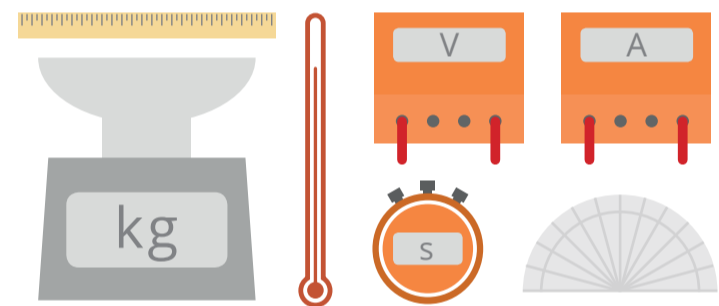
1.1 Physical quantities 




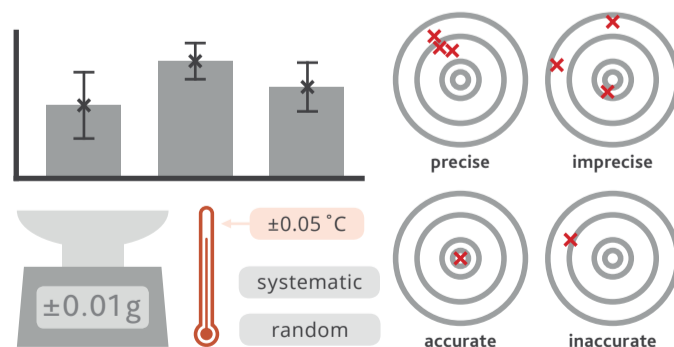
1.2 SI units 





1.4 Scalars and vectors 



2.1 Measurements 



2.2 Errors and uncertainties 



2

Motion

equations of motion

$$v = u + at$$

$$s = (u + v)t/2$$

$$s = ut + 1/2at^2$$

$$v^2 = u^2 + 2as$$

projectile motion
 $g = 9.81 \text{ m s}^{-2}$

3.1 Equations of motion KC

$F = ma$ resultant force acceleration

$p = mv$

1st law: stationary → uniform motion

2nd law: $F = ma$

3rd law: action-reaction

4.1 Momentum and Newton's laws of motion KC

$W = mg$

terminal velocity

MASS: 75kg WEIGHT: 735N

MASS: 75kg WEIGHT: 122N

4.2 Non-uniform motion KC

uniform gravitational field: $F = mg$

uniform electric field: $F = Eq$

5.1 Types of force KC

REPEL, ATTRACT, REPEL

17.1 Concept of an electric field KC

$E = \frac{\Delta V}{\Delta d}$

$F = \frac{QV}{d}$

17.2 Uniform electric fields KC

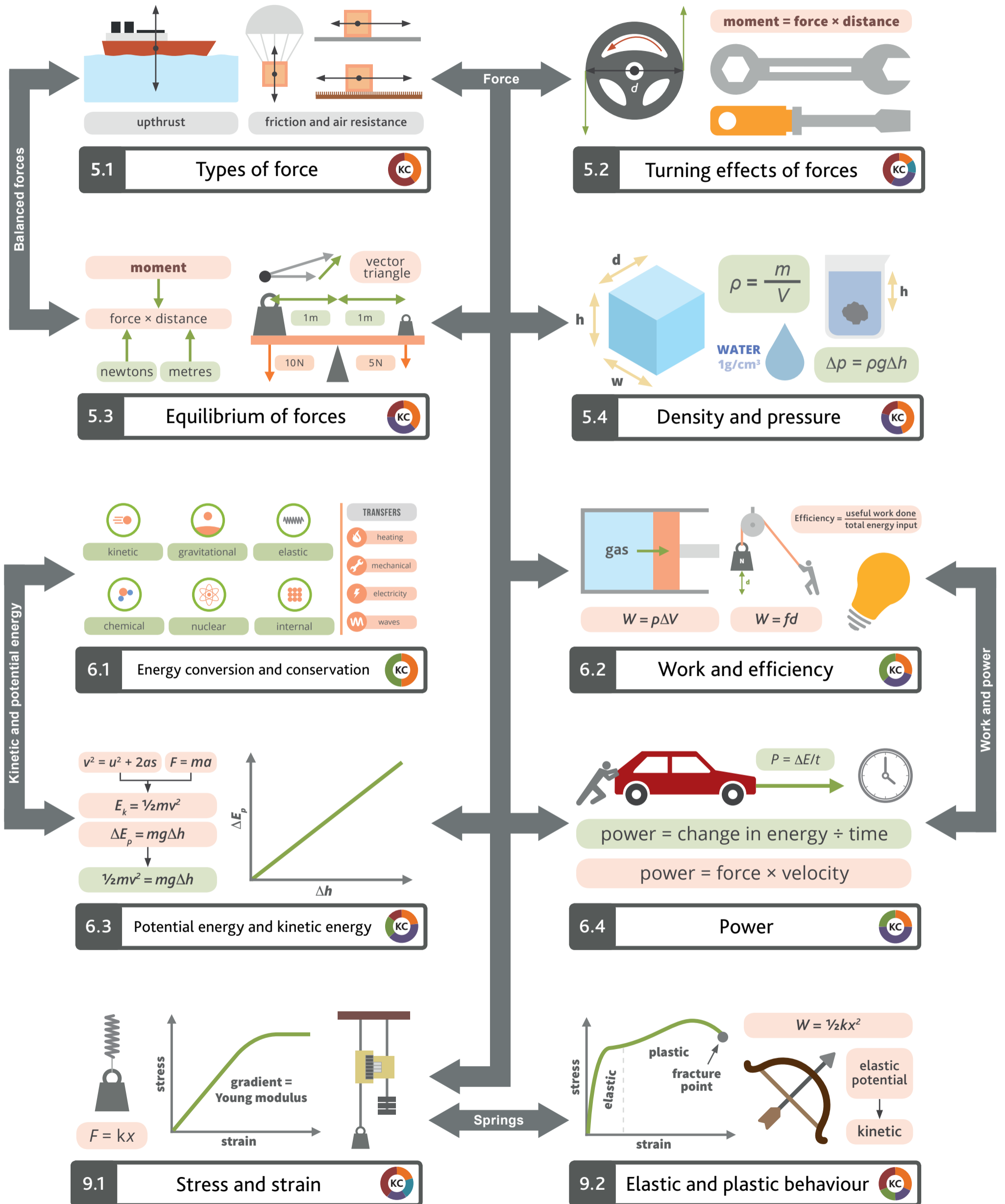
Momentum conserved: $m_1v_1 + m_2v_2 = m_1v'_1 + m_2v'_2$

elastic collision

inelastic collision

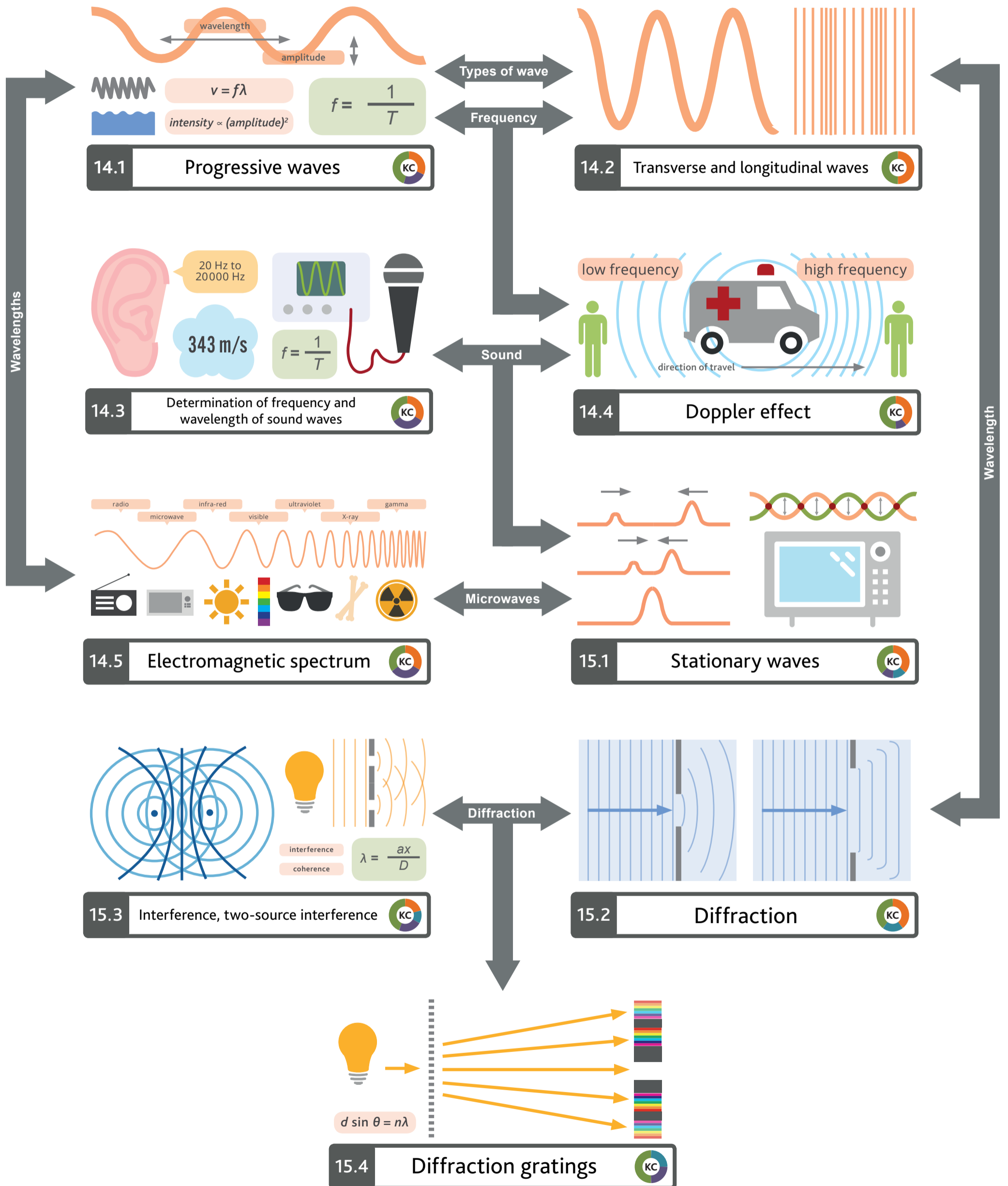
4.3 Linear momentum and its conservation KC

3 Forces, work and materials



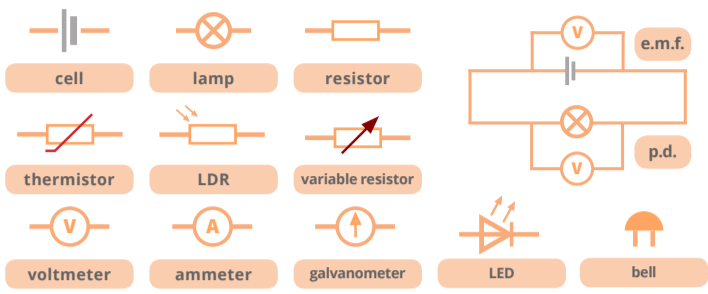
4

Waves

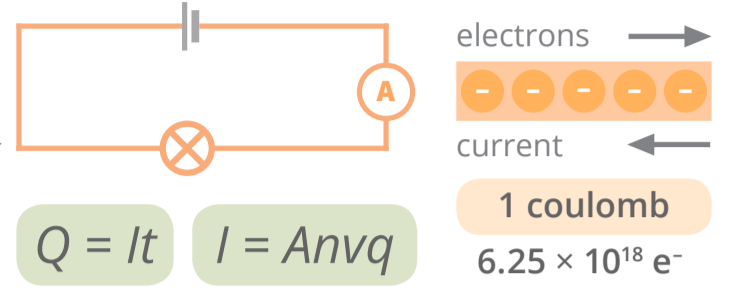


5

Electrical circuits

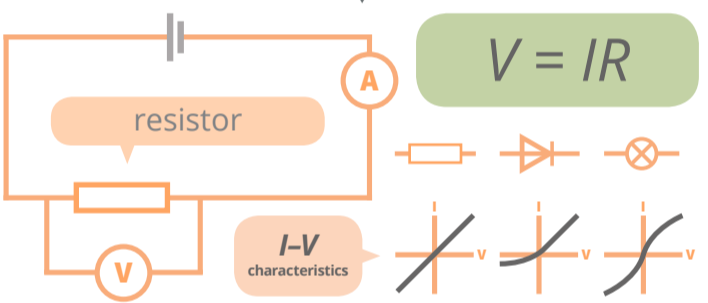
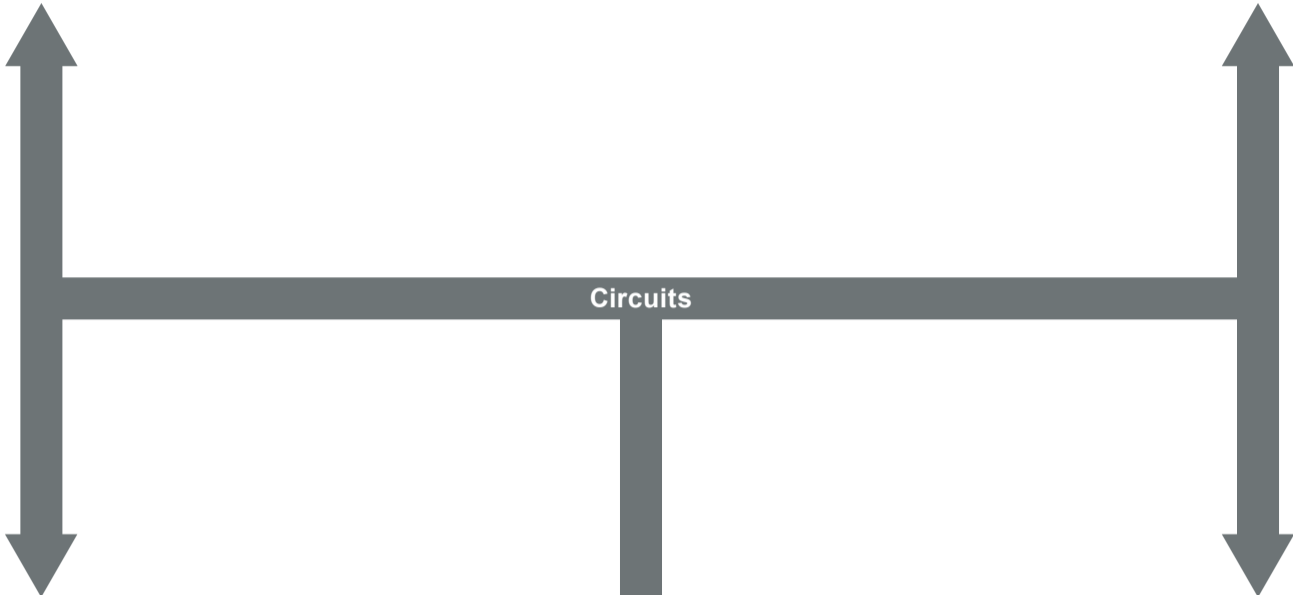


20.1 Practical circuits

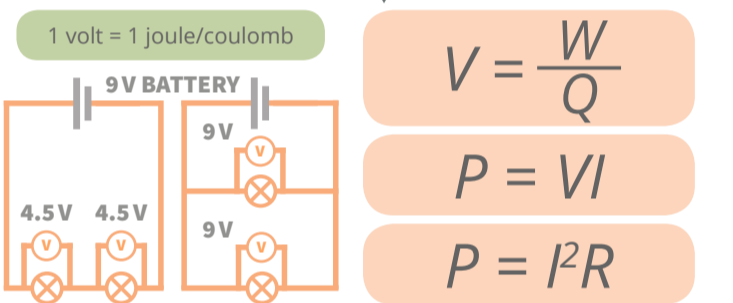


19.1 Electric current

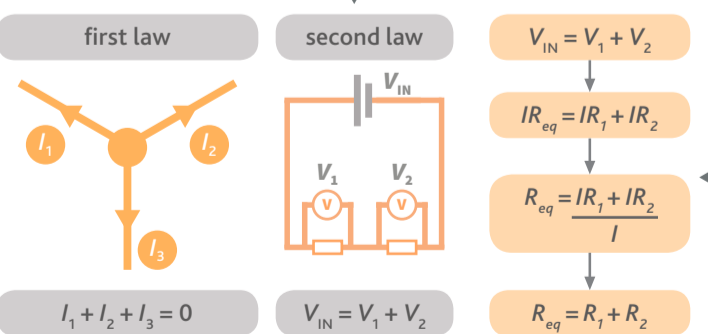
$Q = It$ $I = Anvq$



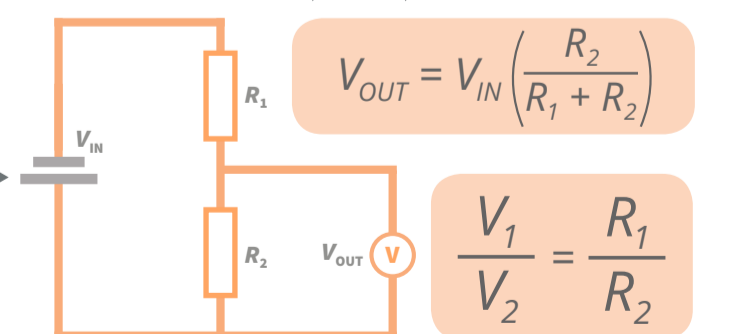
19.3 Resistance and resistivity



19.2 Potential difference and power



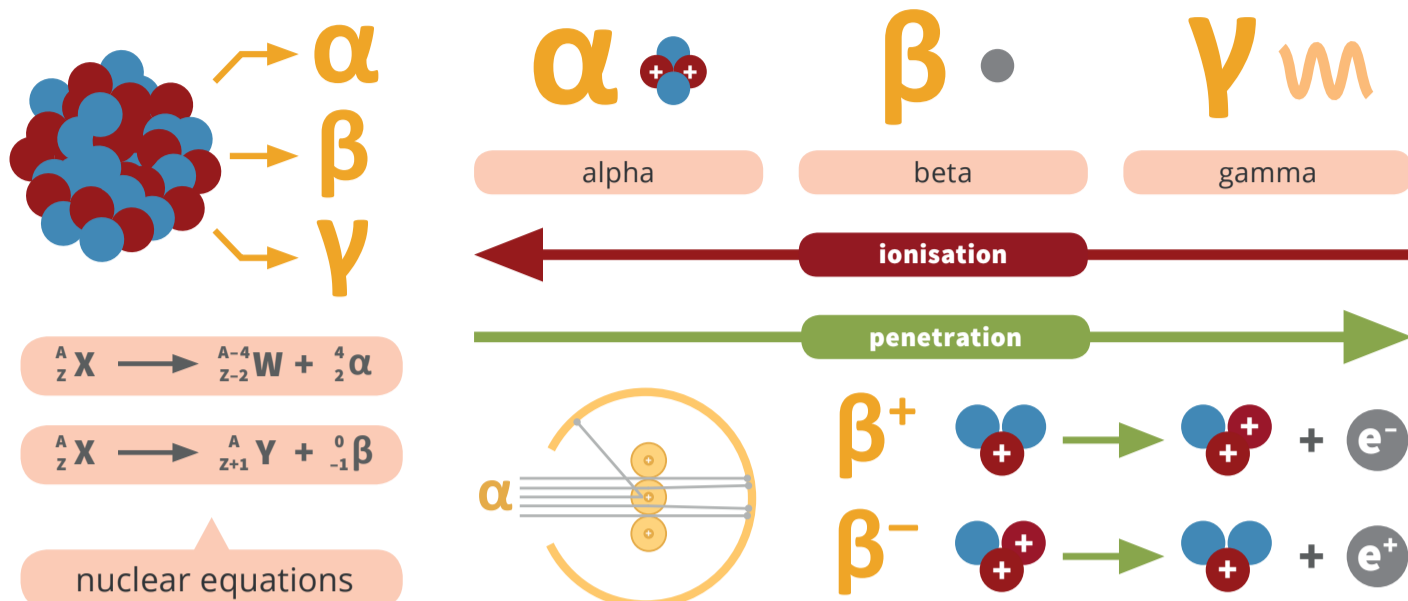
20.2 Kirchhoff's laws



20.3 Potential dividers

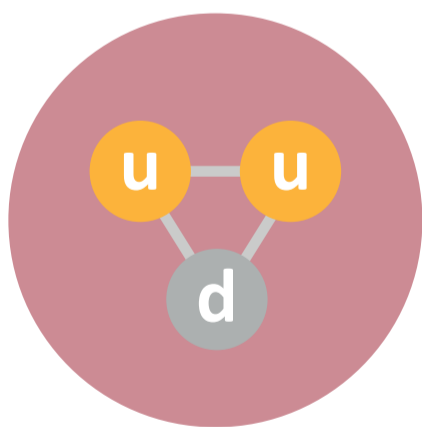
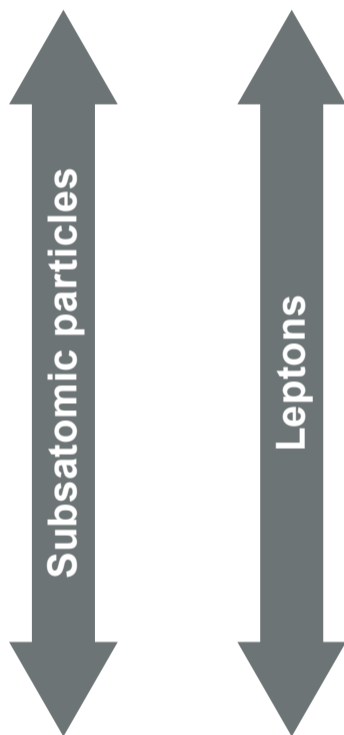
6

Particle physics

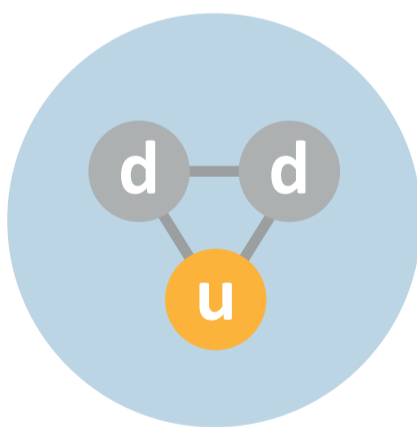


26.1

Atoms, nuclei and radiation



proton



neutron



quarks

leptons



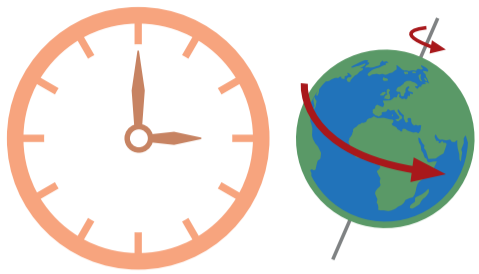
26.2

Fundamental particles



7

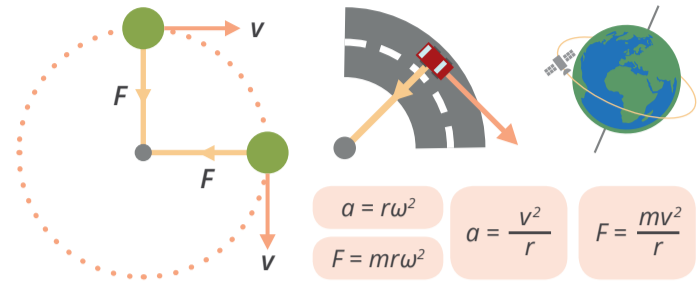
Further mechanics



$180^\circ = \pi \text{ rad}$
 $90^\circ = \pi/2 \text{ rad}$
 $v = r\omega$

Circular motion

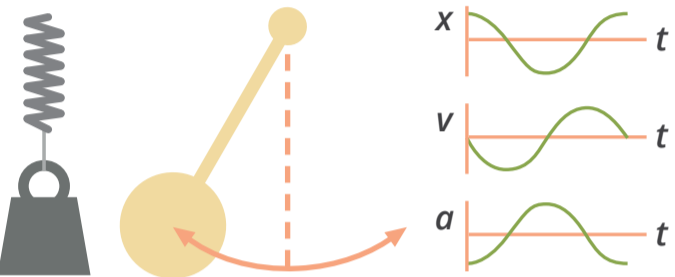
7.1 Kinematics of uniform circular motion **KC**



$a = r\omega^2$
 $F = mr\omega^2$
 $a = \frac{v^2}{r}$
 $F = \frac{mv^2}{r}$

7.2 Centripetal acceleration and centripetal force **KC**

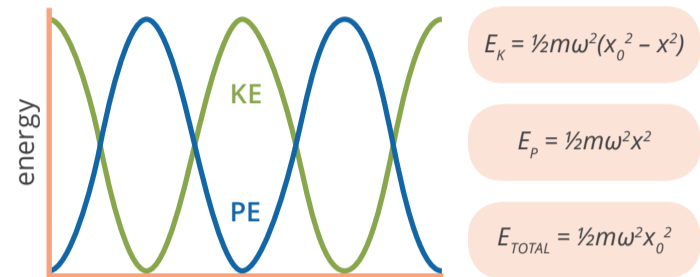
Oscillating systems



13.1 Simple harmonic oscillations **KC**

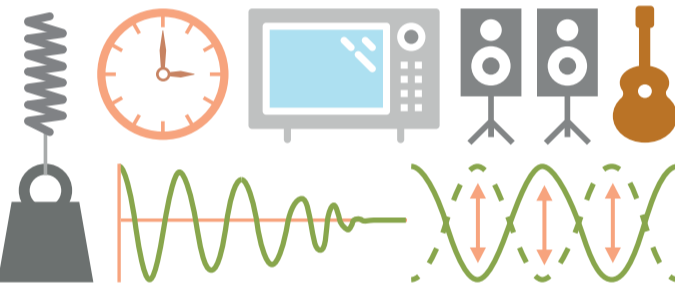
Angular speed

Simple harmonic motion



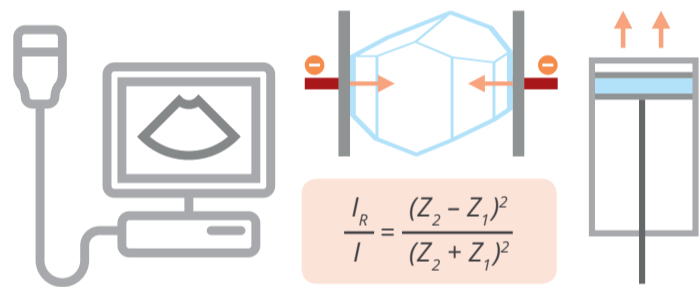
$E_K = \frac{1}{2}m\omega^2(x_0^2 - x^2)$
 $E_P = \frac{1}{2}m\omega^2x^2$
 $E_{TOTAL} = \frac{1}{2}m\omega^2x_0^2$

13.2 Energy in simple harmonic motion **KC**



13.3 Damped and forced oscillations, resonance **KC**

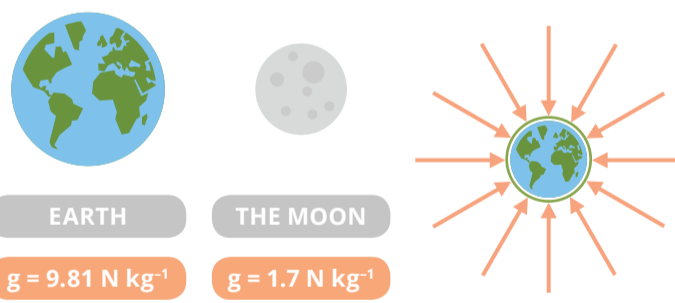
Sound waves



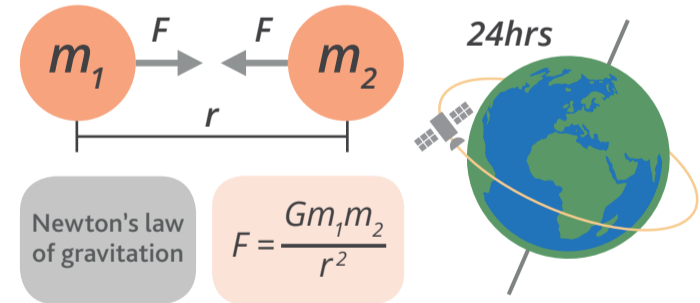
$\frac{I_R}{I} = \frac{(Z_2 - Z_1)^2}{(Z_2 + Z_1)^2}$

14.6 Production and use of ultrasound in diagnosis **KC**

Satellite orbits

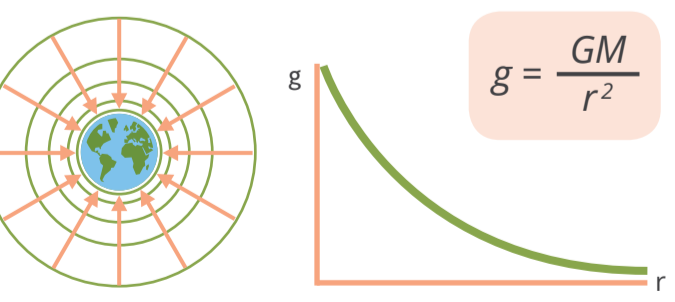


8.1 Gravitational field **KC**

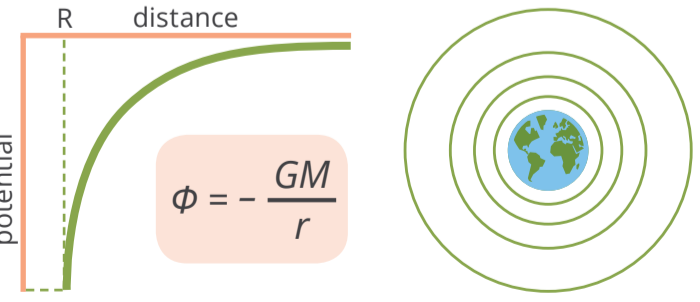


8.2 Gravitational force between point masses **KC**

Gravitational fields



8.3 Gravitational field of a point mass **KC**



8.4 Gravitational potential **KC**

8

Thermodynamics

11.1 Thermal equilibrium KC

11.2 Temperature scales KC

11.3 Practical thermometer KC

12.1 Specific heat capacity and specific latent heat KC

$E = mc\Delta T$

- E energy (J)
- m mass (kg)
- c specific thermal capacity (J/kg°C)
- ΔT change in temperature (°C)

12.2 Internal energy and the first law of thermodynamics KC

$\Delta U = q + w$

- U internal energy
- q energy transferred to the system by heating
- w work done on the system

1.2 SI units KC

6.022×10^{23}
1 MOLE
AMOUNT OF SUBSTANCE

1.3 The Avogadro constant KC

6.022×10^{23} 1 MOLE

10.1 Equation of state KC

$pV = nRT$

- p = pressure
- V = volume
- n = amount of substance
- R = ideal gas constant
- T = temperature

10.2 Kinetic theory of gases KC

10.3 Kinetic energy of a molecule KC

$pV = nRT = nN_A kT = NkT$

$k = \frac{R}{N_A}$

Energy

Thermometers

Moles

Gases

Energy

9 Electricity and electronics

$$F = \frac{Q_1 Q_2}{4\pi\epsilon_0 r^2}$$

17.3 Electric forces between point charges KC

$$E = \frac{Q}{4\pi\epsilon_0 r^2}$$

17.4 Electric field of a point charge KC

$$V = \frac{Q}{4\pi\epsilon_0 r^2}$$

17.5 Electric potential KC



capacitor $C = \frac{Q}{V}$

18.1 Capacitors and capacitance KC

$$W = \frac{1}{2} QV$$

$$W = \frac{1}{2} CV^2$$

18.2 Energy stored in a capacitor KC

19.1 The ideal operational amplifier KC



$$\text{gain} = \frac{V_{OUT}}{V_{IN}} = -\frac{R_f}{R_{IN}}$$

21.2 Operational amplifier circuits KC

21.3 Output devices KC

19.4 Sensing devices KC



20.3 Potential dividers KC

16.1 Communication channels KC

16.2 Modulation KC



digital
analogue

16.3 Digital communication KC

UP DOWN

16.4 Relative merits of channels of communication KC

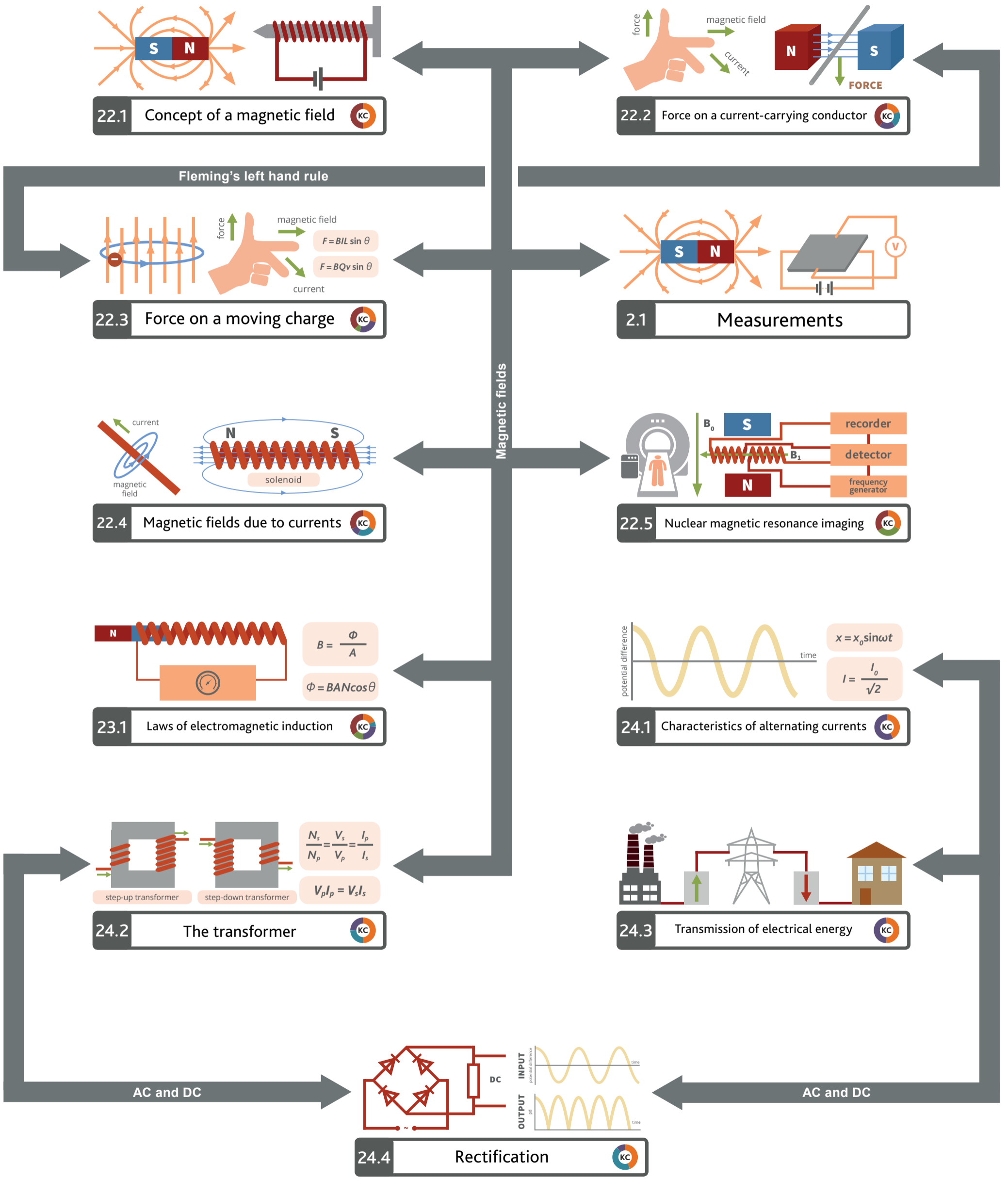
$$\text{decibels} = 10 \log \left(\frac{P_1}{P_2} \right)$$

$$\text{attenuation per unit length} = \frac{1}{L} 10 \log \left(\frac{P_1}{P_2} \right)$$

16.5 Attenuation KC

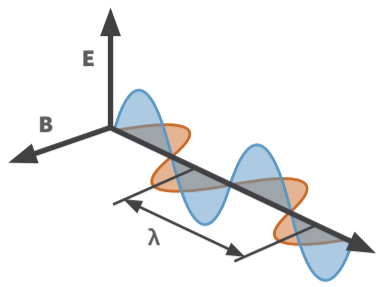
10

Electromagnetism



11

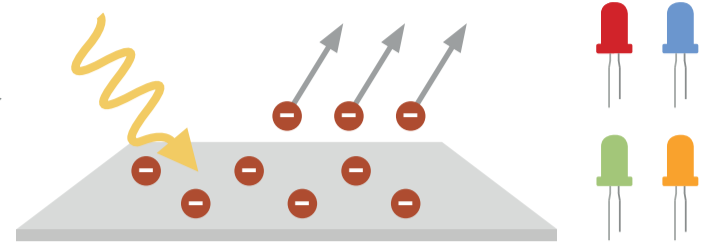
Quantum physics



$$E = hf$$

$$E = \frac{hc}{\lambda}$$

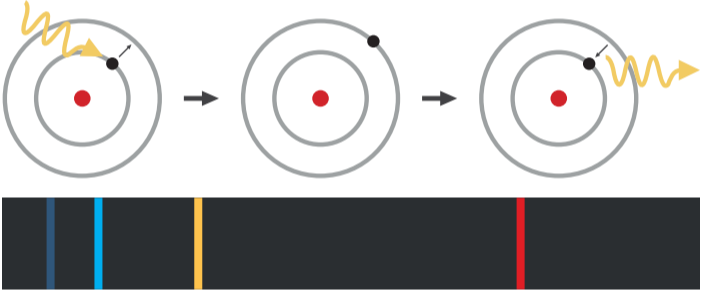
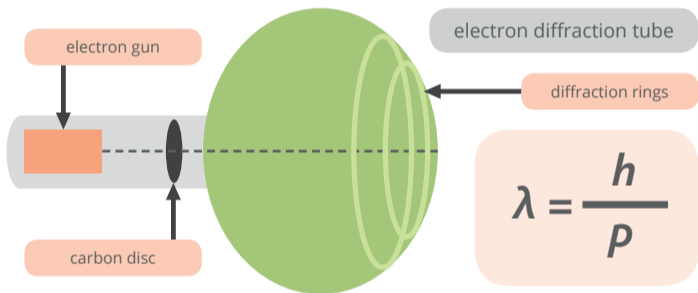
Photons



25.1 Energy of a photon

25.2 Photoelectric emission of electrons

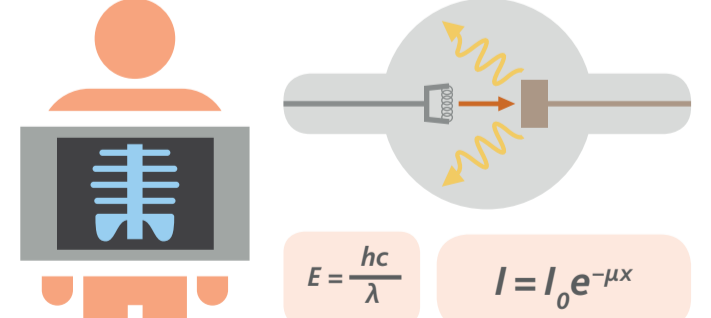
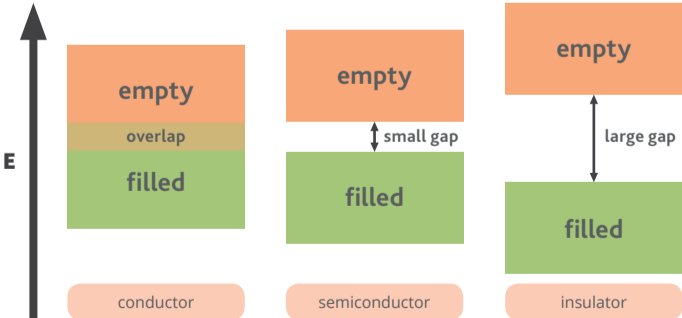
Wave-particle duality



25.3 Wave-particle duality

25.4 Energy levels in atoms and line spectra

Energy levels



25.5 Band theory

25.6 Production and use of X-rays

12

Nuclear physics

binding energy

$${}^{14}_7\text{N} + {}^4_2\text{He} \rightarrow {}^{17}_8\text{O} + {}^1_1\text{H}$$

nuclear equations

He

2p, 2n

26.3 Mass defect and nuclear binding energy KC

Radioactive decay

half life

10g

5g

$$\lambda = \frac{0.693}{t_{1/2}}$$

$A = \lambda N$

α

β

γ

activity

time

26.4 Radioactive decay KC