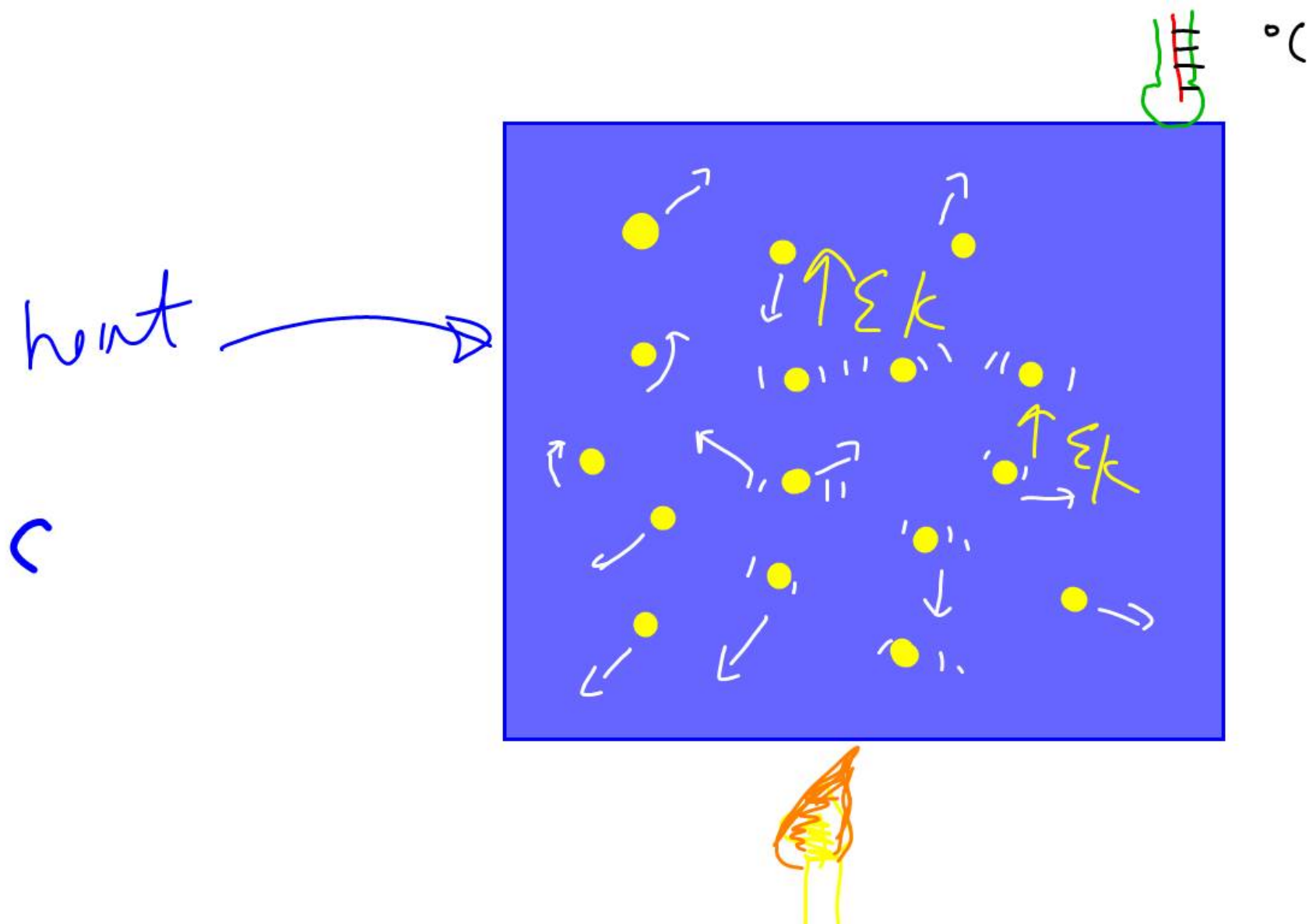
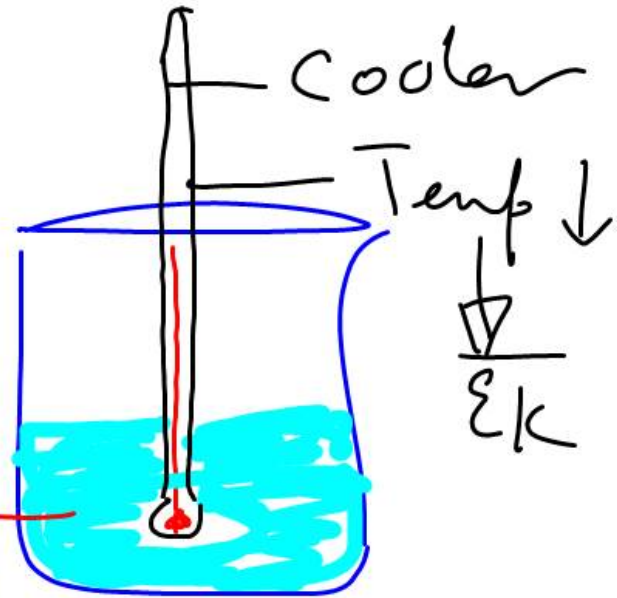
Heat vs Temperature

Heat (symbol: Q) is energy. It is the total amount of energy (both kinetic and potential) possessed by the molecules in a piece of matter. Heat is measured in Joules.

Temperature (symbol: T) is not energy. It relates to the average (kinetic) energy of microscopic motions of a single particle in the system per degree of freedom. It is measured in Kelvin (K), Celsius (C) or Fahrenheit (F).

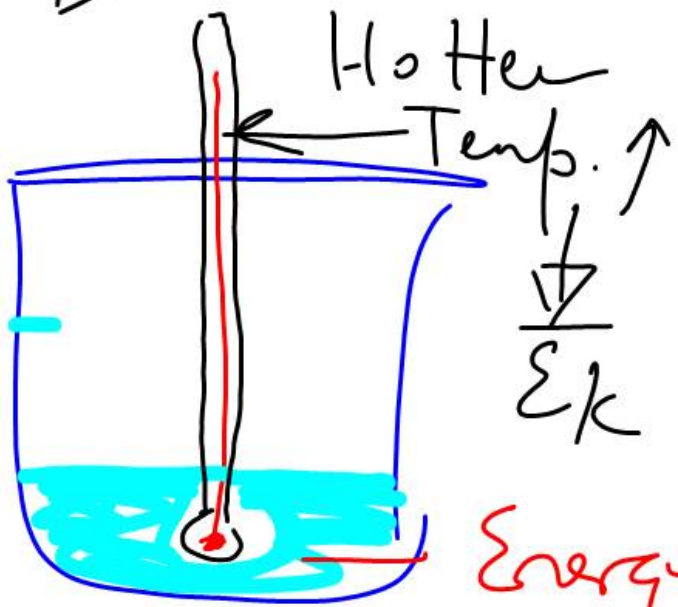

°C
heat
C
↑Σk
↑Σk

A



Energy
= 280J

B

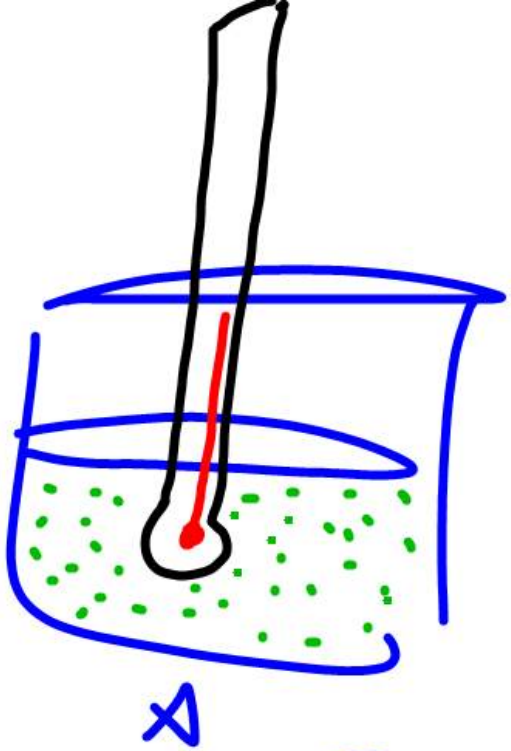


Energy
= 700 J

C

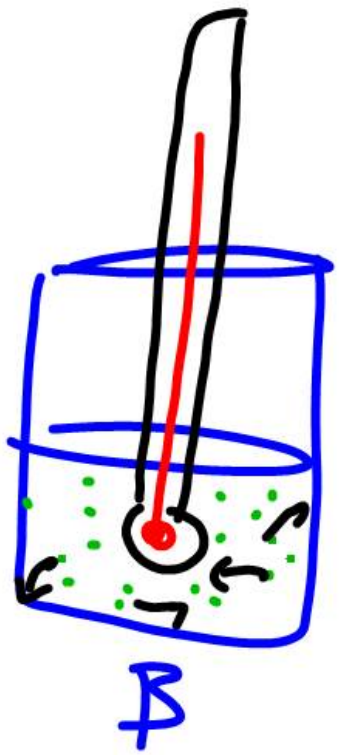
	Heat – $\Sigma E_k + E_p$	Temperature – only E_k measure of the average kinetic energy of the particles
Definition:	Heat is energy that is transferred from one body to another as the result of a difference in temperature.	Temperature is a measure of hotness or coldness expressed in terms of any of several arbitrary scales like Celsius and Fahrenheit.
Symbol:	Q	T
Unit:	Joules	Kelvin, Celsius or Fahrenheit
SI unit:	Joule	Kelvin
Particles:	Heat is a measure of how many atoms there are in a substance multiplied by how much energy each atom possesses.	Temperature is related to how fast the atoms within a substance are moving. The 'temperature' of an object is like the water level – it determines the direction in which 'heat' will flow.
Ability to do work:	Heat has the ability to do work.	Temperature can only be used to measure the degree of heat.

C



Temp ↓

A



B

Temp. ↑

↓

E_k

↓

Movement

Energy A = B.

$$Q = mc\Delta T$$

c

from Celsius	to Celsius
°F = (°C	°C = (°F
°F = (20°C x 1,8) + 32	°C = (68°F − 32) ÷ 1,8
x 1.8)	= 20°C)
68°F	− 32)
C t	/ 1.8 C
+ 32	

Convert from °F to °C

a) 200°F = 93. °C

b) 0°F = -17.8 °C

c) 100°F = 37.3 °C

Convert from °C to °F

9D
9B HW

a) 10°C = 50 °F

b) 32°C = 89.6 °F

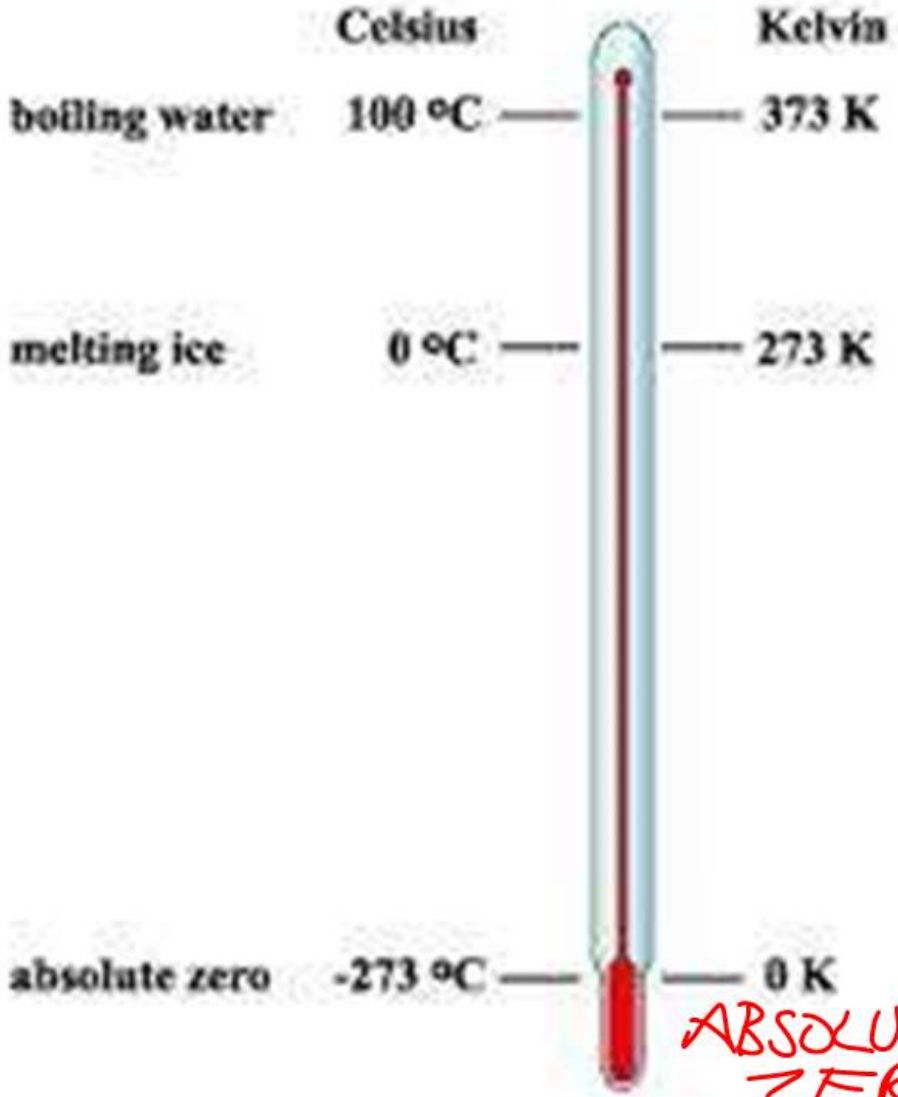
c) 0°C = 32 °F

d) 100°C = 212 °F

e) −60°C = -76 °F

C

B.



5°C → +273

278 K

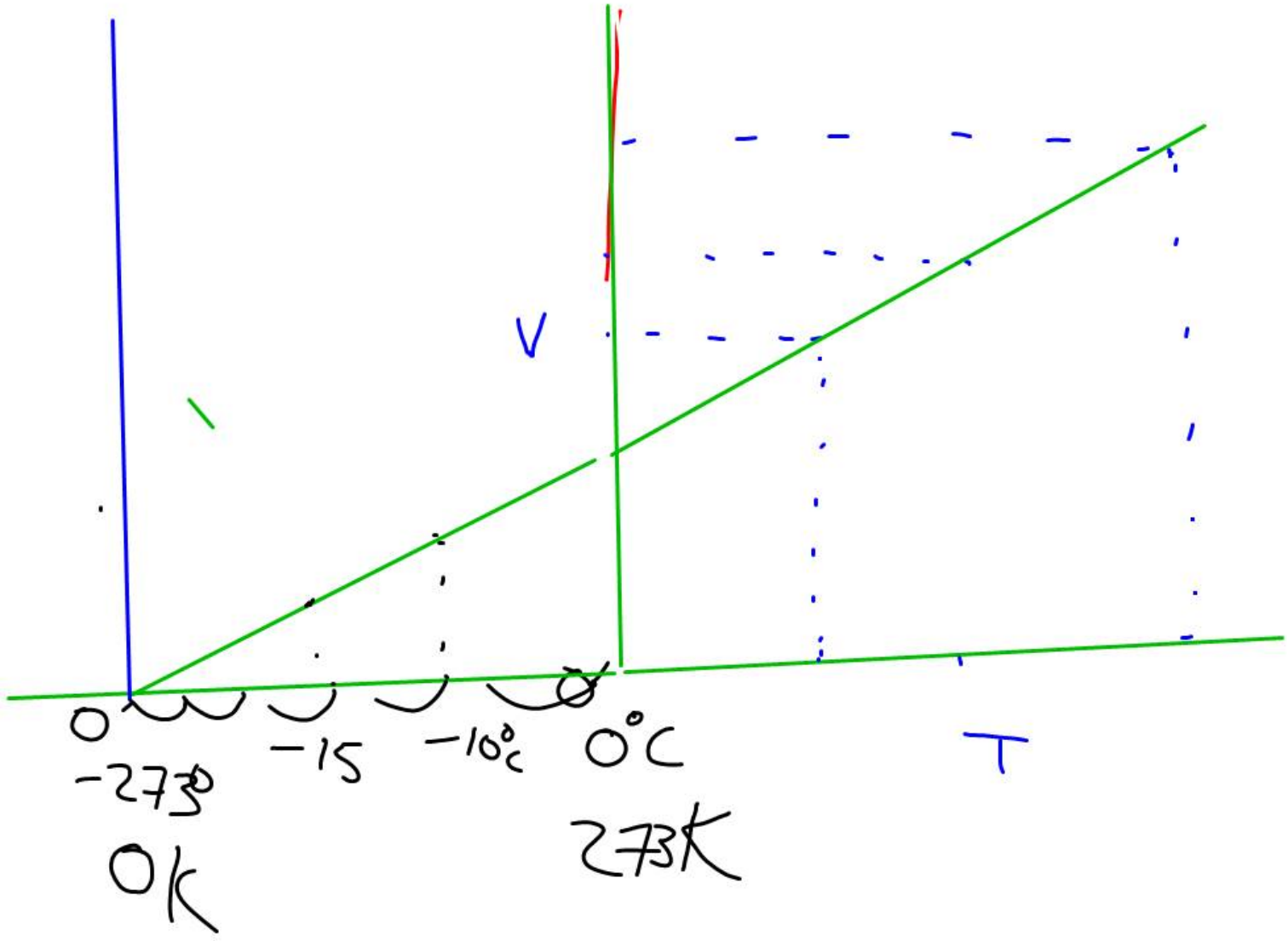
30°C → +273

= 303 K

or

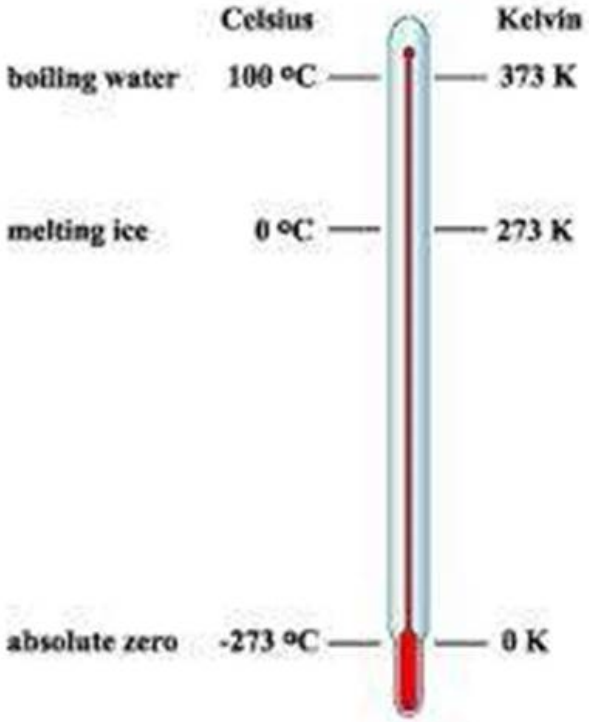
45 K = 45 − 273

= −228°C


V
T
0
-15
-10°c
0°C
-273
0K
273K

Kelvin

SI Unit



$$°C = K - 273$$

Celsius

Kelvin

$$[K] = [°C] + 273$$

Temperature

Kelvin temperature conversion formulae

	from Kelvin	to Kelvin
Celsius	$[°C] = [K] - 273.15$	$[K] = [°C] + 273.15$
Fahrenheit	$[°F] = [K] \times 9/5 - 459.67$	$[K] = ([°F] + 459.67) \times 5/9$
Rankine	$[°R] = [K] \times 9/5$	$[K] = [°R] \times 5/9$

	Kelvin	Celsius	Fahrenheit
Water boils	373.16K	100°C	212°F
Water freezes	273.16K	0°C	32°F
Absolute zero	0K	-273.16°C	-459.7°F

Comparison of Temperature Scales

[Sou

	Kelvin (K)	Celsius (°C)	Fahrenheit (°F)
Absolute zero	0	-273.15	-459.67
Lowest recorded natural temperature on Earth (Vostok, Antarctica - July 21, 1983)	184	-89	-128.2
Water freezes (at standard pressure)	273.15	0	32
Average surface temperature on Earth	288	15	59
Average human body temperature	309.95	36.8	98.24
Highest recorded surface temperature on Earth (Al 'Aziziyah, Libya - September 13, 1922)	331	58	136.4
Water boils (at standard pressure)	373.1339	99.9839	211.97102
Titanium melts	1941	1668	3034
The surface of the Sun	5800	5526	9980

Convert the following temperatures in degrees Celsius(°C) to °F.

(a) 0°C

(b) 100°C

(c) −60°C

(d) −37°C

Convert the following temperatures in degrees Celsius(°C) to °F.

(a) 0°C : = 32°F

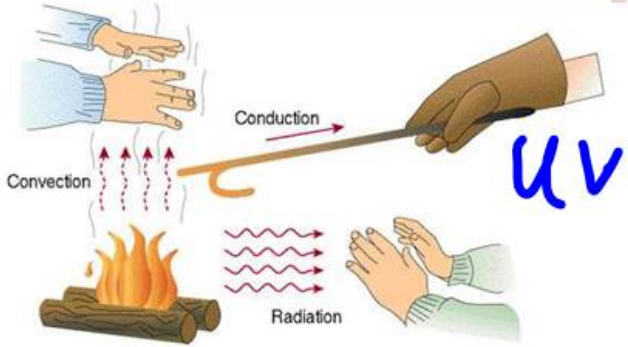
(b) 100°C : = 212°F

(c) −60°C : = −76°F

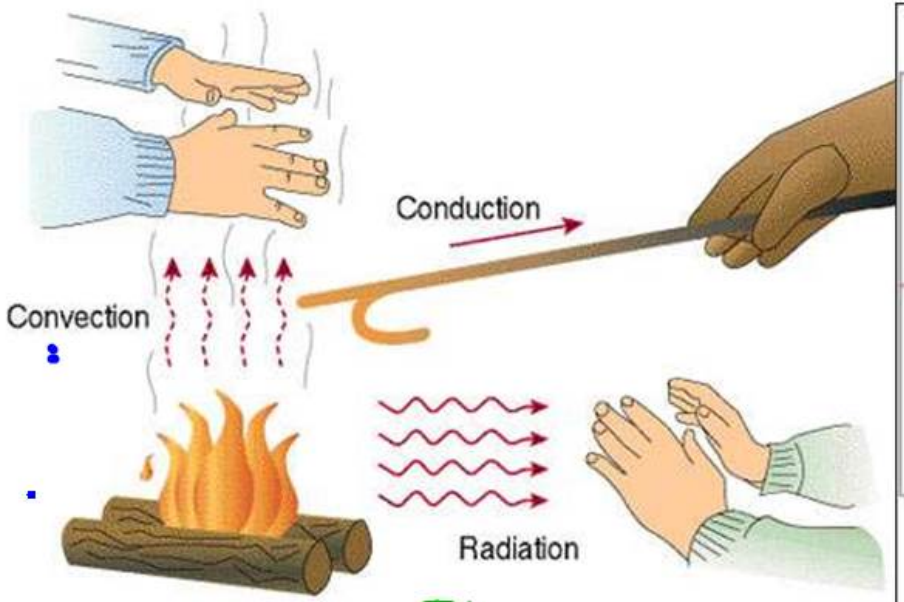
(d) −37°C = − °F

C

Conduction (via direct contact)	Convection (via fluid)	Radiation (via electromagnetic Radiation)
• Conduction is the direct flow of heat through a material resulting from physical contact.	• heat transfer between a surface and adjacent fluid (gas, air or liquid) and by the flow of fluid from one place to another, induced by temperature	• No transfer medium required • It's the transfer of thermal energy through matter of space by electro-magnetic waves.



Micro x-rays
UV rays waves
radio waves, gamma ray
LIGHT

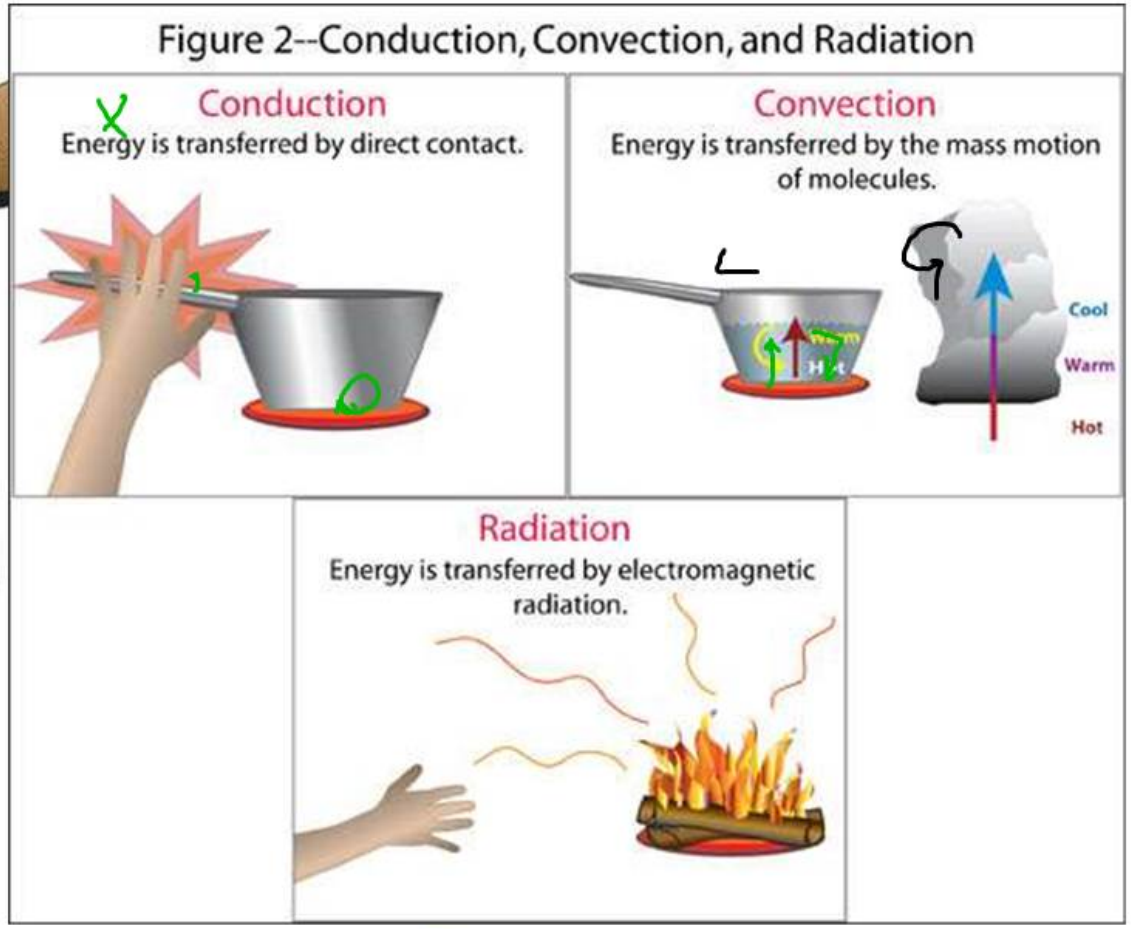


IR

Infra

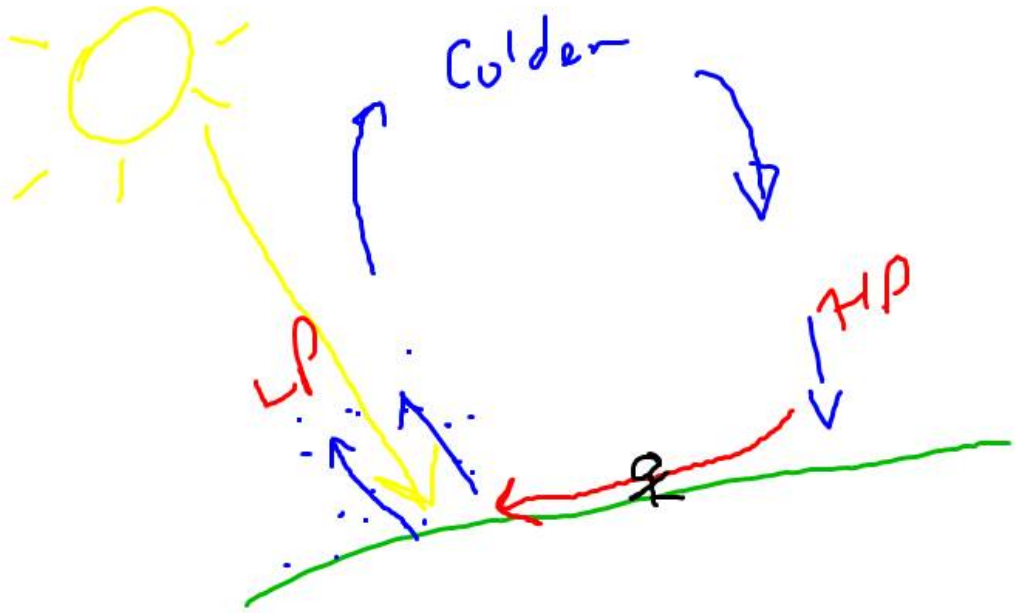
D

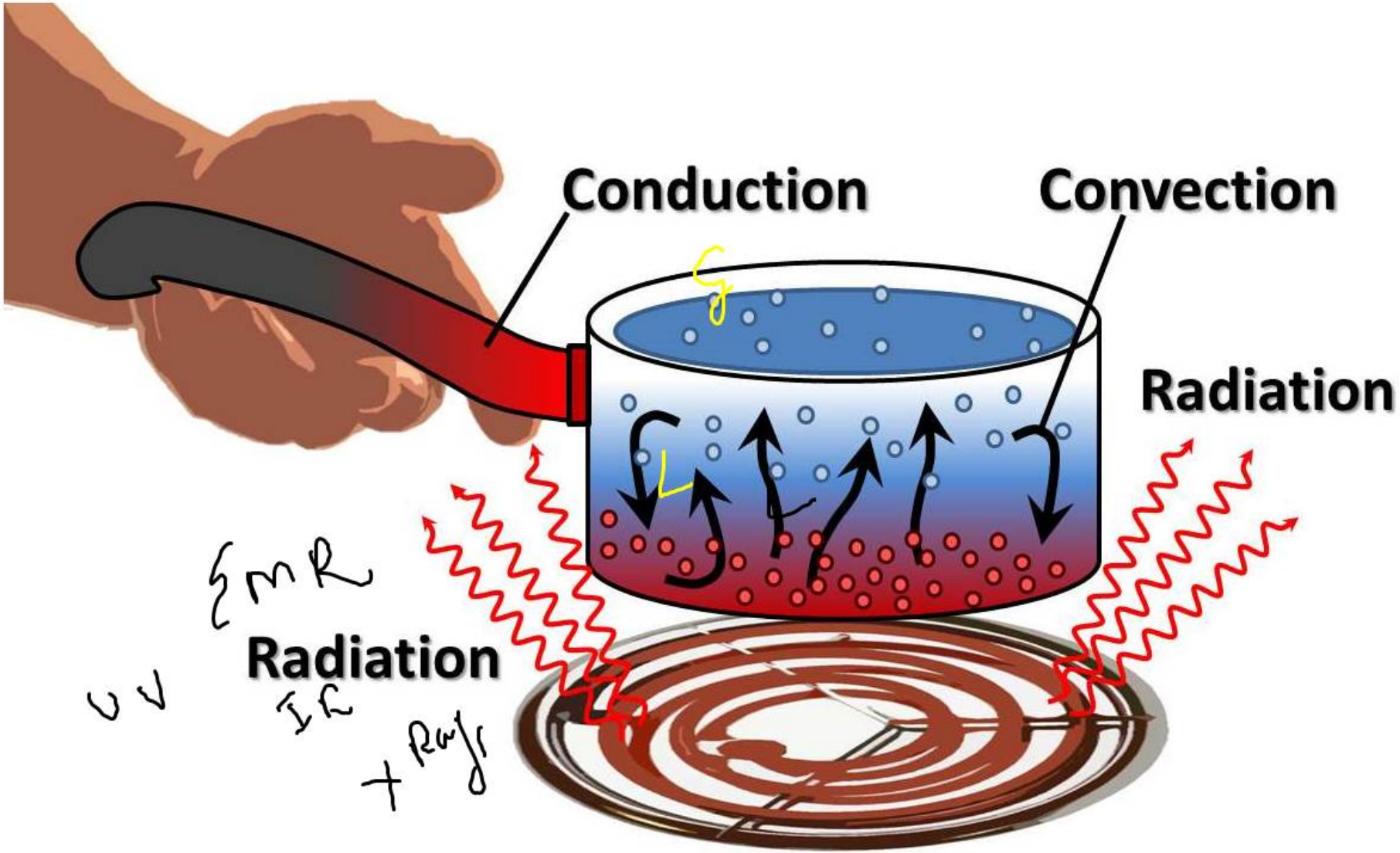
B



EMR

Red


Colder
LP
HP


Conduction
Convection
Radiation
Radiation

D
B
A
C

P2.32 Learning Act. 5 & 6

↳ **Conductor**: good at conducting heat from one point to another within the material as it has free electrons.

[Metals]

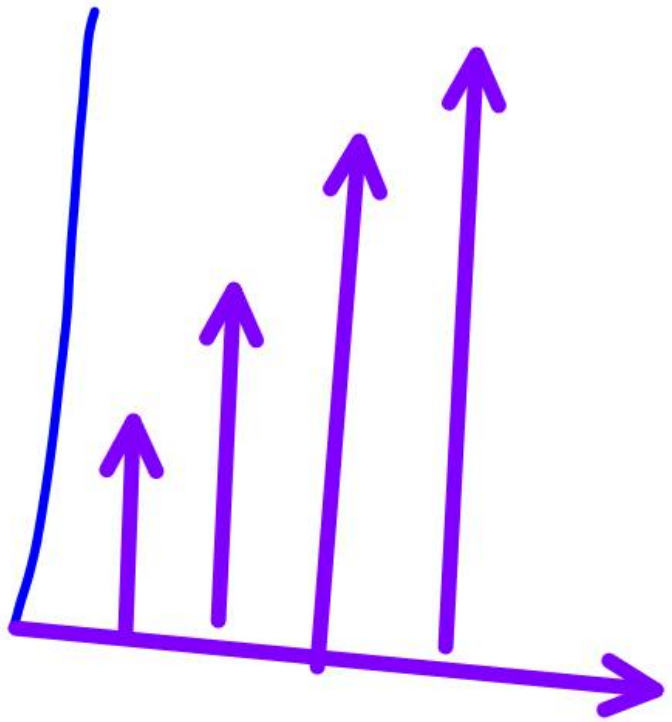
P, B, A, C

Insulator: Are not good at Conducting from one Point to another as they do not have free electrons within.

e.g. Non-Metals

C
B
D

2.35



A