Piazza

Physics 2C 1/21/20

⓪ Quiz 1 Thursday
① Quick Recap of 18.1-18.3
② clickers
③ Thermal Expansion

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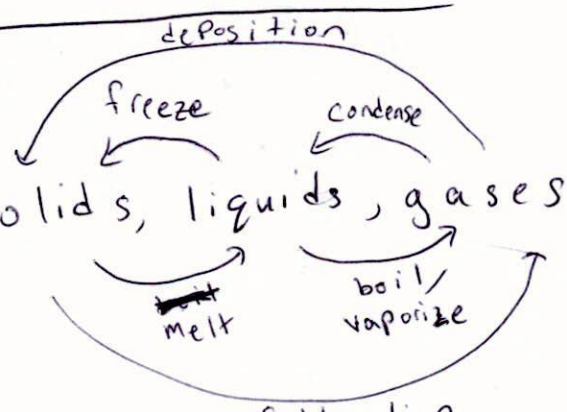
① Quick Recap



Phases of matter: solids, liquids, gases

state variable: $P, V, T, \rho = \frac{M}{V}, \frac{N}{V}$ (number density)

(intensive: does not
vs
extensive: depends on amount of matter)

atomic mass number $A = N(p^+) + N(n^0)$

atomic mass $m(^4He) = 4u$ ← atomic mass unit

1 mole = 6.02×10^{23} basic particles of something

$N_A = 6.02 \times 10^{23}\ mol^{-1}$

molar mass $M_{mol}(He) = 0.004\ kg/mol$

Noble gas: monoatomic ⑦

Diatomics: I_2, Br_2, Cl_2, F_2, O_2, N_2, H_2

Which of the following molecules is monoatomic at room temperature and 1 atm?

A) Chlorine
B) Argon
C) Oxygen
D) Nitrogen
E) None of the above

Oxygen
8
O
16.0
g/mol

Counting molecules, not atoms

Suppose you have a sample of 2.0 mol of Oxygen gas. What is the mass of this sample?

A) 16 grams
B) 32 grams
C) 64 grams
D) None of the above

$$(2.0 \text{ mol } O_2)\left(\frac{2 \times 16.0 \text{ g}}{1 \text{ mol } O_2}\right) = 64 \text{ g}$$

$V_{Cu} \rightarrow M_{Cu} \rightarrow N_{Cu}$

$^{29}_{63.5}Cu$ ③

Which of the following is the best description of the number of copper atoms in a $(10\ cm)^3$ cube of copper (Cu, density 10 g/cm^3)

$$(1000\ cm^3)\left(\frac{10\ g}{1\ cm^3}\right)\left(\frac{1\ mol\ Cu}{63.5\ g\ Cu}\right)\left(\frac{6.02\times10^{23}\ atoms}{mol}\right) \approx 10^{26}\ atoms$$

A) 10^{21} B) 10^{22} C) 10^{23} D) 10^{24}

E) None of the above is the correct order of magnitude

The following are all state variables. Which of the following is an extensive quantity?

A) Pressure int. C) Number density int.

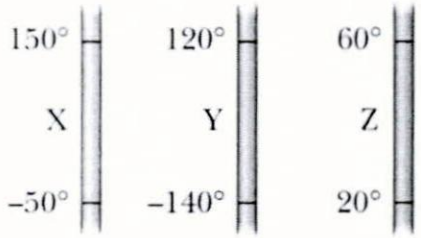
B) Mass ext. D) Temperature int.

"extensive"

"intensive"

If I double my sample, this quantity → doubles / → remains the same

The following figure shows 3 temperature scales with freezing and boiling points of water indicated.



Which of the following is the biggest?

A) 10°X C) 10°Z
B) 10°Y D) (two are the same)

0°X = "absolute zero" ⇒ X is absolute temp scale

Which of the following is an absolute temperature scale?

T: absolute
=
ΔT: not necessary

A) Fahrenheit C) Kelvin
B) Celsius D) (both B and C)

A piston compresses a sample of Nitrogen gas. Describe whether the following quantities

A) Increase C) Remain the same
B) Decrease D) (Undetermined)

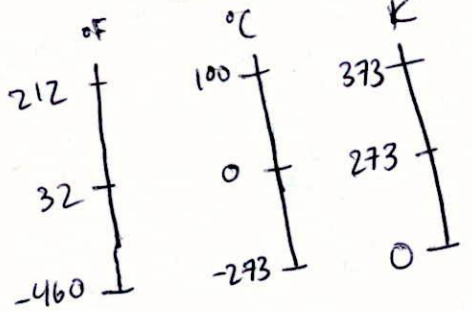
1) Moles of gas (remain the same)
2) Number density (increase)
3) Mass density (increase)
4) Total mass (remain the same)
5) Pressure } undetermined (to be discussed next week)
6) Temperature }

A sample of $^{56}_{26}$Fe (iron-56) has mass M and volume V. A second sample of ^{112}Cd (cadmium-112), has volume $2V$ and the same number of atoms as sample 1. What is the mass of this sample of cadmium?

A) $\frac{1}{4}M$ B) $\frac{1}{2}M$ C) M
D) $2M$ E) $4M$

Temperature: how hot or cold?

(Ch. 20) measures average translational kinetic energy



absolute zero

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③ Thermal Expansion: when you warm an obj. it expands

$$\frac{\Delta L}{L} = \alpha \Delta T$$

fractional increase in length

initial or final?

solids: $\alpha \sim 10^{-5} \frac{1}{K}$

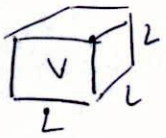
$$\frac{\Delta V}{V} = \beta \Delta T$$

$$= 3\alpha \Delta T$$

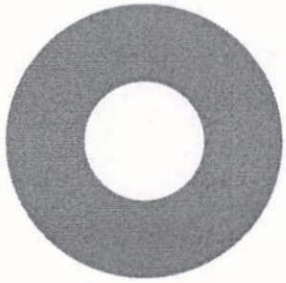
$V = L^3$

$dV = 3L^2 dL$

$\Rightarrow \frac{dV}{V} = 3\frac{dL}{L}$



Brass has a positive coefficient of thermal expansion α ($\Delta L = \alpha L_0 \Delta T$). A ring (annulus) of brass is heated. Does the hole in the middle of the ring get larger or smaller?



A) Larger
B) Smaller
C) Stays the same

why? imagine 2 scenarios