2.1 (a) 
Yocto: \(10^{-24}\)

Moles: \(6.022 \times 10^{23}\)

So 1 yoctomole is 0.6022 items.

Not sure how to split an atom, so 

1 yoctomole of atoms = 0.6 atoms

= no atoms, so my given my current hardware setup.

(b) Century: 100 years

A year = 365 days

day = \(3600 \text{ sec} \cdot 24 \text{ hr}\)

So century = 100 years \(\cdot 365 \text{ days} \cdot \frac{3600 \text{ sec}}{\text{ hr}} \cdot \frac{24 \text{ hr}}{\text{ yr}}\)

= \(3.1536 \times 10^9\) sec

"Nano" = \(10^{-9}\)

So a nano century = 3.154 year

\(\approx 10\)
1 CD = 700 MB
1 MB = 10^6 bytes

"peta" = 10^15

so a petabyte is \( \frac{10^{15}}{10^6} \) bytes = \( \frac{10^9}{CD} \)

1 CD is \( \frac{1.2}{2847} \) m
1.2 mm = 0.0012 m
= 1.2 \( \cdot \) 10^{-3} m

so a stack of CDs is \( \frac{10^9 \cdot 1.2 \cdot 10^{-3}}{CD} \) CD

\( = 1.2 \cdot 10^6 \) m tall

The "Burj Khalifa" building is \( \approx 800 \) m
\( = 8 \cdot 10^2 \) m tall

\( \Rightarrow \) a petabyte stack of CDs is \( \frac{1.2 \cdot 10^6}{8 \cdot 10^2} \)
\( \approx 1.5 \cdot 10^5 \) times taller
\[ (2.3) \quad 10^{60} \text{ atoms \& number} \]

\[ \Rightarrow 10^{60} \text{ positions in string} \]

eq \[ \text{string is} \quad 1, 2^2 + 1, 2^1 + 1 \cdot 2^0 \]

so \[ 10^{60} \text{ \( \ldots \)\}'s in a string \# is} \]

\[ 2^{80} + 2^{79} + 2^{78} + \ldots + 2^1 + 2^0 \]

\[ = x^0 + x^1 + x^2 + x^3 \]

\[ = a + ar + ar^2 + ar^3 + \ldots = \sum_{k=0}^{n-1} ar^k \]

\[ n/a = 1 \quad \Rightarrow \quad r = 2 \]

\[ = a \left( \frac{1-r^n}{1-r} \right) \quad \bigg| \begin{array}{c}
    a = 1 \\
    r = 2 \\
    n = 81
  \end{array} \]

\[ = \left( \frac{1 - 2^{81}}{1 - 2} \right) = \frac{1 - 2^{81}}{-1} \]

\[ = 2^{81} - 1 \]

\[ \text{sig.} \]
(2.4) \( g_{\text{sea}} \) at surface = 10 m/s²

\[ g_{\text{sea}} =? \quad M_0 \rightarrow M_2 \rightarrow M_4 \]

\[ F_g = \frac{M_0 \cdot m_2 \cdot G}{r^2} = m_0 \cdot g_{\text{sea}} \]

\[ g_0 = \frac{m_1 \cdot G}{r^2} = \frac{1 \text{ kg} \cdot \text{m}}{1 \text{ m}^2} \]

\[ = 6.67 \cdot 10^{-11} \text{ m}^3/\text{kg} \cdot \text{s}^2 \]

\[ g_0 = 6.67 \cdot 10^{-11} \text{ m/s}^2 \]

\[ \text{dB} = 20 \log_{10} \frac{g_{\text{sea}}}{g_0} \]

\[ = 20 \log_{10} \frac{10^{12}}{6.67} \]

\[ = 20 \log_{10} \frac{10^{12}}{6.67} \]

\[ = 20 \left( \log_{10} 10^{1.2} - \log_{10} 6.67 \right) \]

\[ = 20 \left( 12 \cdot \log_{10} 10 - \log_{10} 6.67 \right) \]

\[ = 20 \left( 12 - 0.82 \right) = 223.5 \text{ dB} \]
(2.5) \[ \text{TNT}\ldots\text{many} \]

\[ \text{Nitrogen} \ldots \]

energy

- stored in ... electrical bonds?

- between N atoms...

- what's the energy of a bond?

- how many N atoms are bonded?

I need to know connecting...

Let's say energy of a

atom's excitation: 1 eV \( \Rightarrow \) breaking a bond?

\[ \frac{\text{eV}}{\text{atom}} \]

"nuclear excitation": \( 10^6 \text{eV} \)

\( \Rightarrow \) break apart atoms

\( (2) \)

in \( X \) N atoms, how may bonds?

Assume they arrange in lattice...

cubic lattice would be 6

neglects.
Let's say $g$ neighbors per atom.

Each bond has energy $E = g \times N$ atoms.

$$E_T = X \cdot g \cdot e$$

... but this will double-count some bonds, because "neighbor" is reciprocal.

... forget how to account for this, but...

Let's ignore for now (may be huge error)

$$N$$

How many atoms $X$ in ton? $= 10^3$ kg

ea. $N$ has mass $\frac{1}{m} \text{ kg}$

So $X = \frac{10^3 \text{ kg}}{N \text{ kg}}$

So $E_T = X \cdot g \cdot e = \frac{10^3 \text{ kg} \cdot g \cdot e}{M \text{ kg}}$

$$E_T = \frac{10^3 \text{ kg} \cdot g \cdot e}{M \text{ kg}}$$

\[ \uparrow \quad \uparrow \quad \uparrow \]

# of every per bond neighbors
(should drop redundancies)