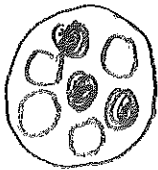


Nuclear physics

nucleus  contains Z protons and N neutrons

protons and neutrons are called nucleons (also baryons)
 $\uparrow$
 [heavy, vs. electrons]

Z (atomic number) determines the charge of the nucleus

$(Q = Ze)$ $\therefore$ the element

Isotopes are elements w/ different numbers of neutrons N
 ["same place"]

Define $A = Z + N = \# \text{ of nucleons} = \text{baryon number}$

Since $m_n \approx m_p \approx 1.7 \times 10^{-27} \text{ kg}$

the mass of the nucleus is proportional to A

$A = \text{mass number}$.

Symbol:

$\begin{matrix} A \\ Z \end{matrix} X$

Nuclide = type of nucleus w/ specific $z + A$.
[Segre chart of nuclide]

ZA2

■ stable isotope

□ unstable ^(radioactive) isotope (decays into other nuclides w/ some half life $T_{1/2}$)

□ naturally occurring radioactive

(very long lived, $T_{1/2} \gtrsim 1$ billion yrs)

Most elements have 2 or more stable isotopes,

one of which is ^{the} most abundant, which is why mass is close to an integer

H

^2H = deuterium (heavy hydrogen)

[explain symbol]

^3H = tritium ($12 \text{ yr} = T_{1/2}$)

^{12}C

^{13}C

^{14}C unstable but produced in atmosphere, decays in dead objects ($T_{1/2} \sim 6000$ years)

^{35}Cl

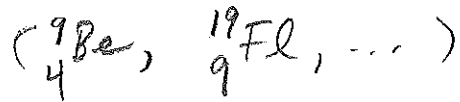
75%

^{37}Cl

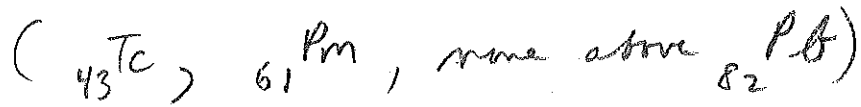
25%

} $\Rightarrow$ naturally occurring Cl: 35.5

Some elements have only one stable isotope

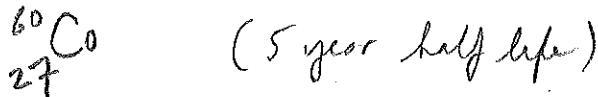


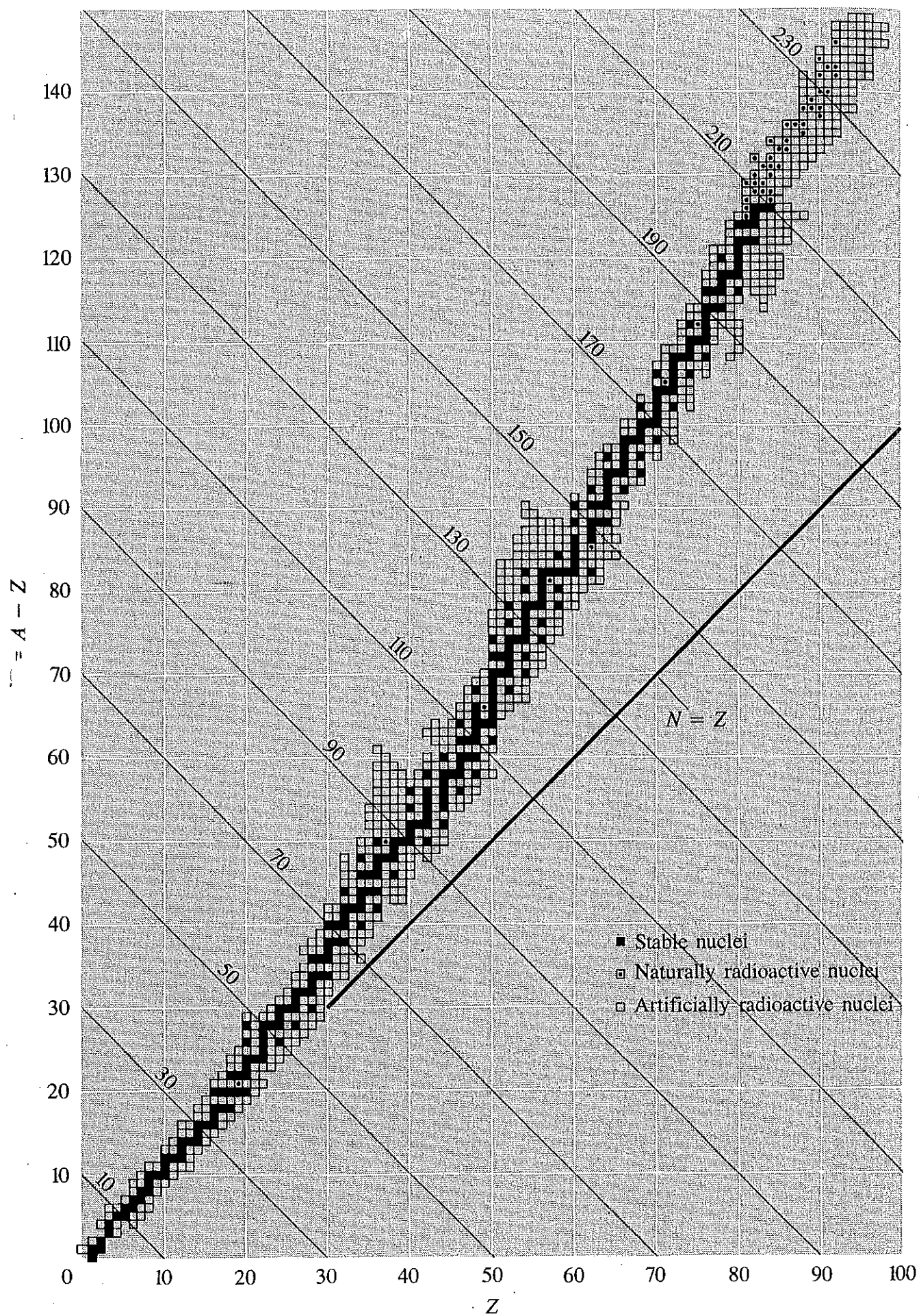
Some have none



All elements above Pb radioactive
and no naturally occurring above U.

Radioactive elements created in nuclear reactors
in atmosphere, & in stars when they
explode.





20

30

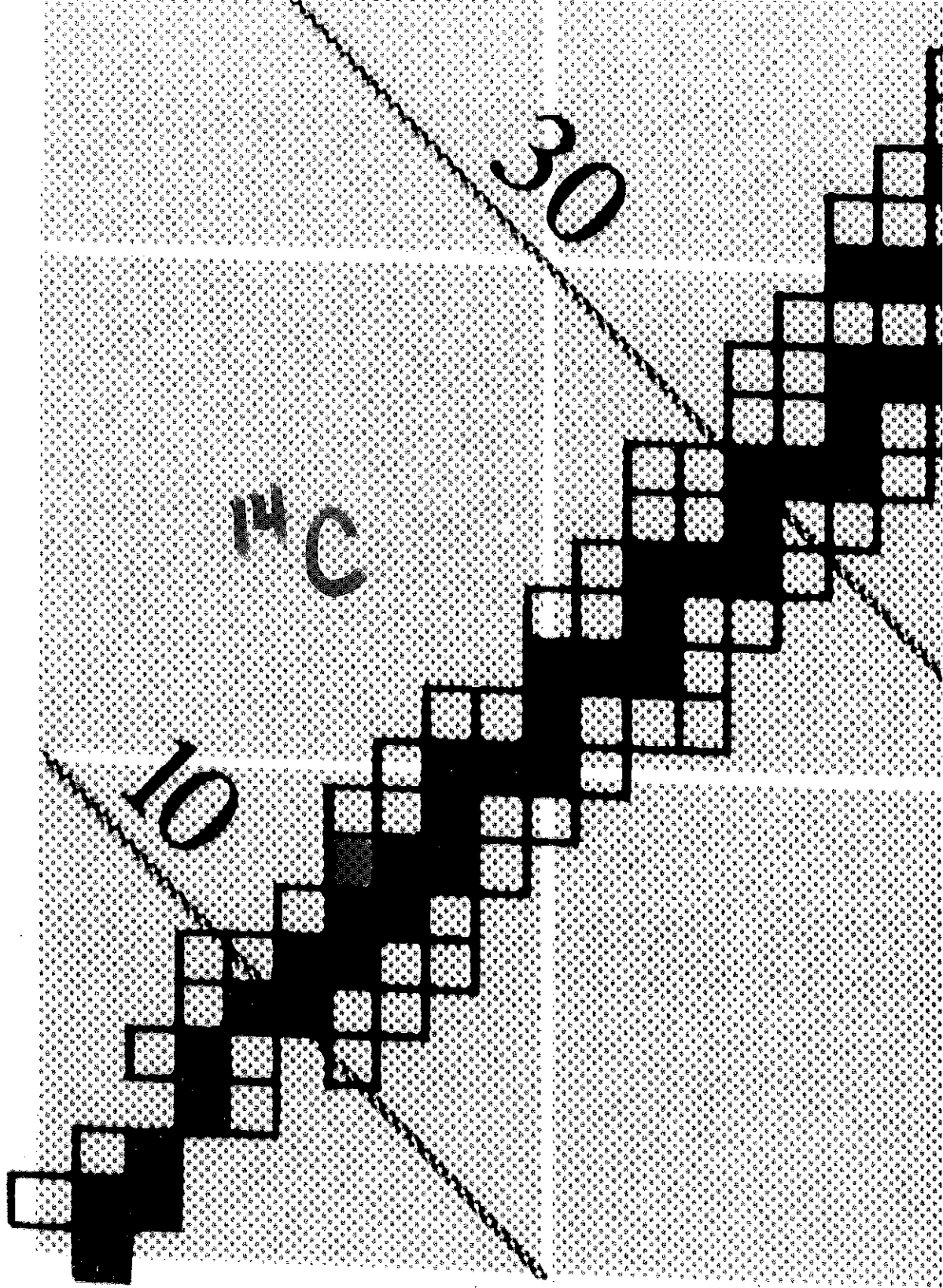
^{14}C

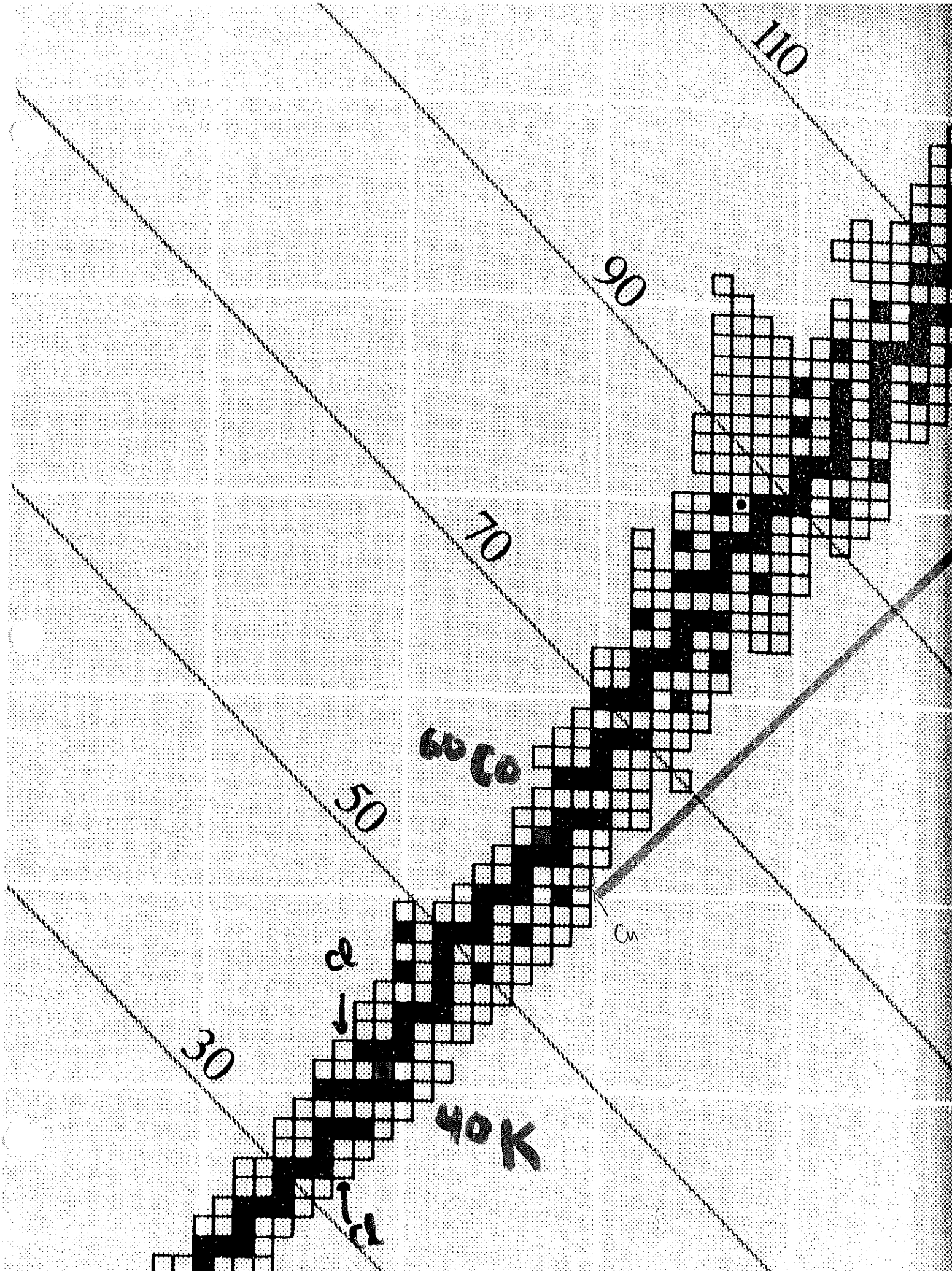
10

10

0

10





230

210

