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2.1-110

Which requires the most energy?

(a) breaking up molecules into atoms
(b) breaking up atoms into nuclei & electrons
(c) breaking up nuclei into neutrons & protons
(d) breaking up protons into quarks

2.1-120

Which forces operate over the same length scale?

(a) the nuclear & the electromagnetic
(b) the gravitational & the nuclear
(c) the electromagnetic & the gravitational
(d) all of the above

2.1-130

Which forces operate on neutral particles ?

(a) the nuclear only
(b) the electromagnetic only
(c) the gravitational only
(d) the nuclear and gravitational only

2.1-135

When two similarly charged particles approach each other, they

(a) accelerate
(b) decelerate
(c) maintain speed
(d) accelerate or decelerate depending on the conditions

2.1-140

Nuclei formed before the first stars had up to

(a) 1
(b) 3
(c) 6
(d) 26

protons.

2.1-150

Nuclei in small stars accumulate up to

(a) 3
(b) 6
(c) 26
(d) 83

protons.

2.1-161

Nuclei in small stars accumulate no more than 6 protons because

(a) the nuclei don't have enough energy to overcome electrostatic repulsions above this limit

(b) there are not enough protons

(c) mass is not converted to energy in forming nuclei above this limit

(d) the neutrons get in the way

2.1-170

Nuclei in large stars accumulate up to

(a) 3
(b) 6
(c) 26
(d) 83

protons.

2.1-181

Nuclei in large stars accumulate no more than 26 protons because

(a) the nuclei don't have enough energy to overcome electrostatic repulsions above this limit

(b) there are not enough protons

(c) mass is not converted to energy in forming nuclei above this limit

(d) the neutrons get in the way

2.1-210

Which of the following has 9 protons and 10 neutrons?

(a) $^{10}_{9}X$ (b) $^{9}_{10}X$

(c) $^{19}_{9}X$ (d) $^{9}_{19}X$

2.1-220

Which of the following pairs of nuclei have the same chemical properties?

(a) ${}^{14}_{6}X$, ${}^{14}_{7}X$

(b) ${}^{14}_{6}X$, ${}^{13}_{6}X$

(c) ${}^{14}_{6}X$, ${}^{15}_{7}X$

Which of the above pairs of nuclei have the same mass?

Which of the above pairs of nuclei have the same number of neutrons?

2.1-230

Which of the following is the most stable arrangement of 10 protons and 10 neutrons?

(a) ${}^{4}_{2}He$ & ${}^{16}_{8}O$ with total mass 19.99752 u

(b) ${}^{3}_{2}He$ & ${}^{17}_{8}O$ with total mass 20.01534 u

(c) ${}^{6}_{3}Li$ & ${}^{14}_{7}N$ with total mass 20.018195 u

(d) ${}^{10}_{5}B$ & ${}^{10}_{5}B$ with total mass 20.025874 u

2.1-240

Given the masses

v for a $^{0}_{-1}e$

w for a $^{1}_{1}p$

x for a $^{1}_{0}n$

y for a $^{1}_{1}H$ atom

z for a $^{4}_{2}He$ atom

the Δm for formation of a $^{4}_{2}He$ nucleus is <u>NOT</u>

(a) (z) - (2 x + 2 y)

(b) (z) - (2 w + 2 x)

(c) (z - 2 v) - (2 w + 2 x)

(d) (z) - (2 v + 2 w + 2 x)

2.1-250

The Δm for formation of one ^{3}He nucleus is -0.0071885 u. Since c^2 = 931.494 MeV / amu
= 8.987836×10^{13} J / gm, the nuclear binding energy, in MeV per atom is

(a) (931.494) (0.0071885) / 3
(b) 3 (8.987836×10^{13})
(c) (0.0071885) (8.987836×10^{13})
(d) (931.494) (0.0071885)

in MeV per nucleon is ?

in J per mole is ?

2.1-310

Which is untrue?

(a) $^{4}_{2}He$ is a helium nucleus

(b) $^{4}_{2}He$ is an alpha particle

(c) $^{4}_{2}He$ is a beta particle

(d) $^{4}_{2}He$ is an isotope of helium

2.1-320

Which is untrue?

(a) ${}^{0}_{-1}\beta$ is a beta particle

(b) ${}^{0}_{1}\beta$ is a positron

(c) ${}^{0}_{-1}\beta$ is an electron

(d) ${}^{1}_{1}p$ is a positron

2.1-410

The nuclear decay process

$$^{60}_{27}\mathrm{Co} \rightarrow {}^{60}_{28}\mathrm{Ni} + ?$$

is an example of

(a) beta decay
(b) positron emission
(c) alpha decay
(d) electron capture

2.1-420

The nuclear decay process

$$^{222}_{86}Rn \rightarrow {}^{218}_{84}Po + ?$$

is an example of

(a) beta decay
(b) positron emission
(c) alpha decay
(d) electron capture

2.1-430

$^{14}_{7}N$ is stable but $^{14}_{6}C$ is unstable. The latter decays by

(a) beta emission
(b) positron emission
(c) alpha emission
(d) electron capture

What is the product of the decay ?

(a) $^{14}_{7}N$

(b) $^{13}_{6}C$

(c) $^{13}_{7}N$

(d) $^{14}_{5}B$

2.1-440

$^{19}_{9}F$ is stable but $^{18}_{9}F$ is unstable.
The latter decays by

(a) beta emission
(b) positron emission or electron capture
(c) alpha emission

What is the product of the decay ?

(a) $^{18}_{10}Ne$

(b) $^{19}_{10}Ne$

(c) $^{17}_{8}O$

(d) $^{18}_{8}O$

2.1-450

Nuclei with 26 protons and 27 neutrons are positron-emitters. The stable isotopes of the same element have

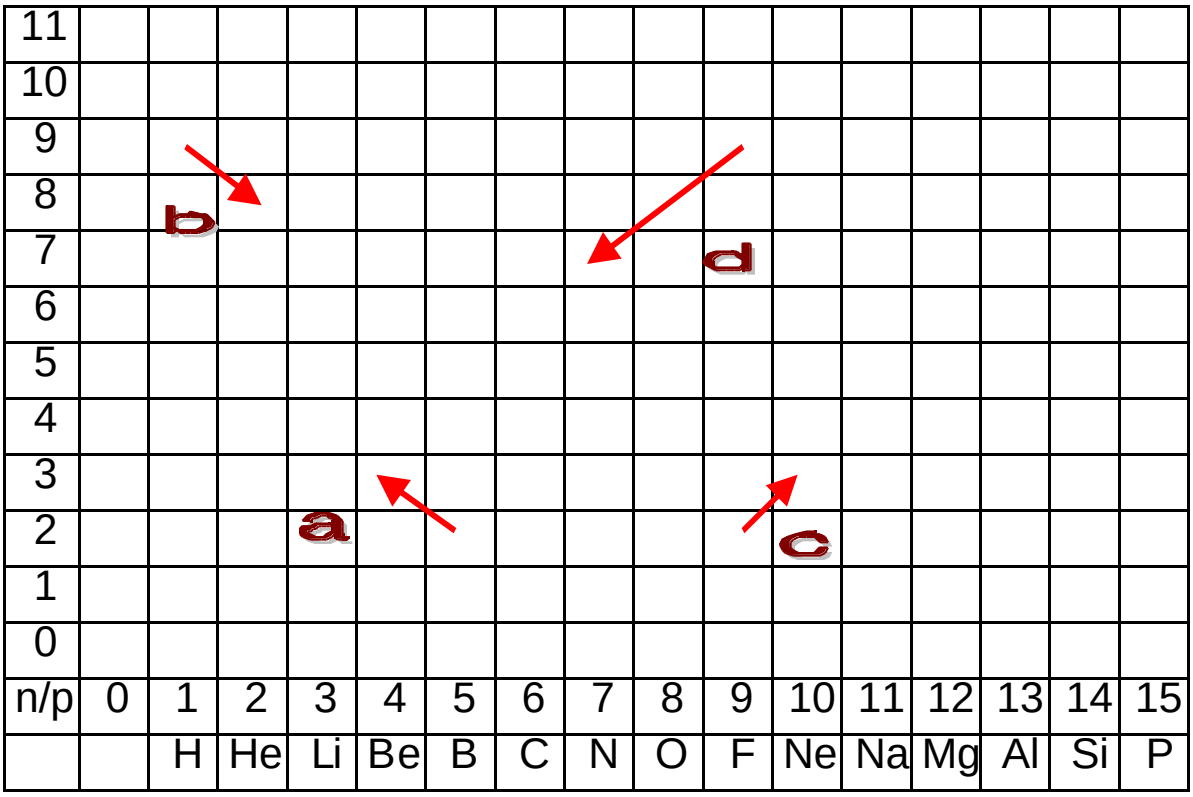
(a) more than 26 protons
(b) more than 27 neutrons
(c) less than 26 protons
(d) less than 27 neutrons

2.1-460

11							**b**									
10																
9																
8																
7																
6						**d**						**a**				
5							**c**									
4																
3																
2																
1																
0																
n/p	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Which cell corresponds to $^{11}_{6}C$?

2.1-470



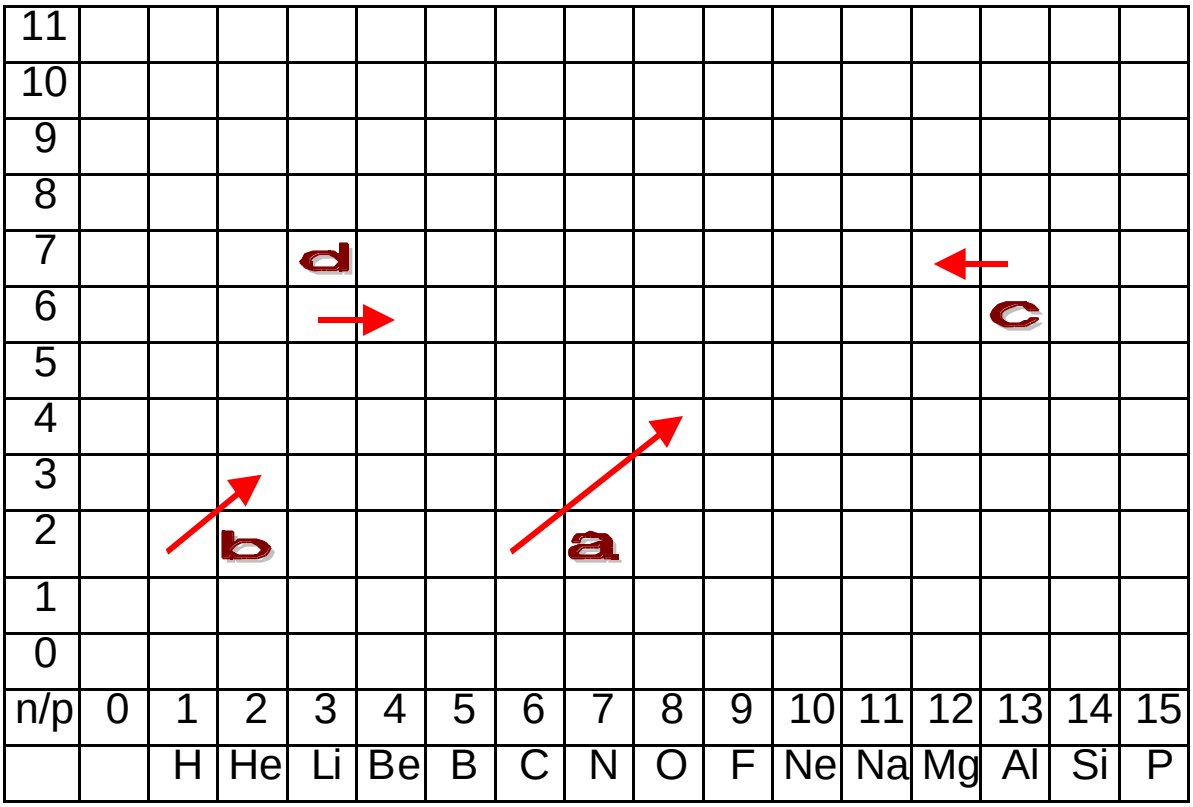
Which arrow corresponds to beta decay?

Which arrow corresponds to electron capture?

Which arrow corresponds to positron emission?

Which arrow corresponds to alpha decay?

2.1-480



Which arrow corresponds to ${}^{1}_{1}p$ emission?

Which arrow corresponds to ${}^{1}_{1}H$ fusion?

Which arrow corresponds to ${}^{2}_{1}H$ fusion?

Which arrow corresponds to ${}^{4}_{2}He$ fusion?

2.1-490

Neutron bombardment of $^{14}_{7}N$ produces a proton and

(a) $^{14}_{6}C$

(b) $^{15}_{6}C$

(c) $^{15}_{7}N$

(d) $^{15}_{8}O$

2.1-510

When one half-life has elapsed, half of the radioactivity in a sample is gone (by definition of the "half-life"). When a second half-life has elapsed

(a) the radioactivity is still half the initial value
(b) the other half of the radioactivity is gone
(c) one quarter of the radioactivity remains
(d) none of the above

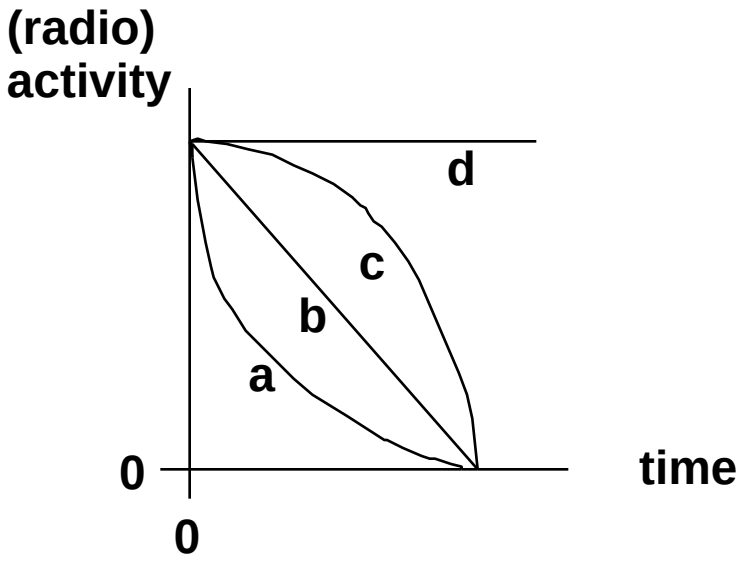
2.1-520

The half-life of $^{14}_{6}C$ is 5730 years. To date a sample that is 4(5730)=22920 years old, one needs to be able to measure what fraction of the original radioactivity?

(a) 1/4
(b) 1/8
(c) 1/16
(d) none of the above

2.1-530

Which of the following is a correct?



2.1-540

The half-life of $^{14}_{6}C$ is 5730 years. In a sample that is (1/2)(5730)=2865 years old, the fraction of the original $^{14}_{6}C$ radioactivity remaining will be closest to

(a) 3/4
(b) 7/10
(c) 2/3

2.1-550

The radioactivity of a sample has declined by a factor of 5 in 3 months. Assuming that there is only one radioactive species in the sample, that species must have a half-life of

(a) between 0.5 and 1 months
(b) between 1 and 1.5 months
(c) between 1.5 and 2 months

2.1-560

Cereal grains from ruins in Jericho have a ^{14}C specific activity of 0.171 Bq / g of ^{12}C. Given that the specific activity would have been 0.255 Bq / g of ^{12}C when the grains were harvested, and the half-life of ^{14}C is 5730 years, which equation should be solved to determine how many years ago the ruins were inhabited?

(a) (0.171 / 0.255) = e^(- t / 5730)
(b) (0.171 / 0.255) = (1/2)^(t / 5730)
(c) (0.171 / 0.255) = e^(-5730 t)
(d) (0.171 / 0.255) = 2^(-5730/t)

2.1-570

$^{14}_{6}C$ originates in the atmosphere and has a half-life 5730 years. It is therefore good for dating

(a) mineral specimens formed over 40,000 years ago
(b) mineral specimens formed under 40,000 years ago
(c) samples derived from plants over 40,000 years ago
(d) samples derived from plants under 40,000 years ago

2.1-580

All the ^{238}U found in meteorites is believed to have been deposited there when the solar system formed. ^{238}U decays to ^{206}Pb with a half-life of 4.51×10^9 years. There is no other source of ^{206}Pb. Meteorites are found to have 1.03 times as many atoms of ^{206}Pb as of ^{238}U. The age in years of the meteorites can be determined by solving which equation?

(a) $(1.00 / 2.03) = (1/2)^{(t / 4.5 \times 10^9)}$
(b) $(1.00 / 1.03) = (1/2)^{(t / 4.5 \times 10^9)}$
(c) $(1.03 / 2.03) = (1/2)^{(t / 4.5 \times 10^9)}$