

Unit 4 ASG ONLINE

A 7.7-MeV alpha particle (+2e) is fired at a thin foil of aluminium (+13e). At what distance from the nucleus will the alpha particle have transferred 75% of its initial kinetic energy?

Select one:

- ☐ a. $4.9 \times 10^{-15} \text{ m}$
- ☐ b. $6.5 \times 10^{-15} \text{ m}$
- ☒ c. $3.2 \times 10^{-15} \text{ m}$
- ☐ d. $1.3 \times 10^{-14} \text{ m}$

According to Einstein's mass-energy equivalence formula, which of the following is an equivalent unit for mass?

Select one:

- ☒ a. Js/m^2
- ☐ b. Ns/m
- ☐ c. kgm^2/s^2
- ☐ d. Ns^2/m

According to the quark model, a proton consists of quarks represented as

Select one:

- ☒ a. uud
- ☐ b. cud
- ☐ c. dud
- ☐ d. udd

Analysis of a Particle Track

A particle curves within the uniform magnetic field inside a bubble chamber represented below.

Evidence

$$v = 1.54 \times 10^6 \text{ m/s}$$

$$B = 7.08 \text{ T}$$

$$r = 4.52 \text{ mm}$$

The density of the bubble track suggests **two elementary charges**.



From the evidence in the **Analysis of a Particle Track**, the charge-to-mass ratio of the particle is:

Select one:

- ☐ a. $4.81 \times 10^4 \text{ C/kg}$
- ☐ b. $2.08 \times 10^{-8} \text{ C/kg}$
- ☐ c. $2.41 \times 10^9 \text{ C/kg}$
- ☒ d. $4.81 \times 10^7 \text{ C/kg}$

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An electron travels at 2.5×10^6 m/s perpendicular to a magnetic field with a strength of 2.0×10^{-3} T. The radius of curvature of its path is:

Select one:

- ☒ a. 1.4×10^{-3} m
- ☐ b. 7.1×10^{-3} m
- ☐ c. 1.4×10^2 m
- ☐ d. 7.1×10^2 m

A particle accelerator is used to accelerate protons to an energy of 4.5 MeV. Assuming the protons start from rest, what is the maximum speed reached by the protons?

Select one:

- ☐ a. 1.5×10^7 m/s
- ☐ b. 2.9×10^7 m/s
- ☐ c. 8.6×10^{14} m/s
- ☐ d. 9.8×10^1 m/s

A theoretical isotope with an atomic number Z undergoes the following decay series: **beta minus**, **alpha**, **alpha**, **beta positive**, and **alpha**. What is the atomic number of the resulting nucleus?

Select one:

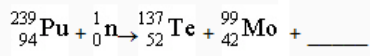
- ☐ a. Z +6
- ☐ b. Z +4
- ☐ c. Z -6
- ☐ d. Z -4

High-energy particle accelerators are required for studying subatomic particles because

Select one:

- ☐ a. ionization of atoms requires a lot of energy
- ☐ b. nuclear forces are very strong
- ☐ c. radioactive decay is too dangerous
- ☐ d. primary cosmic rays are too weak

How many neutrons are liberated in the following fission reaction?



Select one:

- ☐ a. 6
- ☐ b. 3
- ☐ c. 4
- ☐ d. 7

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How many neutrons exist in the lead isotope Pb-206?

Select one:

- ☐ a. 124
- ☐ b. 206
- ☐ c. 82
- ☐ d. 288

How much mass, in amu, is equivalent to 2.0 MeV?

Select one:

- ☐ a. 3.6×10^{-30} amu
- ☐ b. 1.3×10^{16} amu
- ☐ c. 2.2×10^{-11} amu
- ☐ d. 2.1×10^{-3} amu

In the reaction ${}^{14}_6\text{C} \rightarrow {}^{14}_5\text{B} + \text{X}$, what does **X** represent?

Select one:

- ☐ a. neutron
- ☐ b. positron
- ☐ c. electron
- ☐ d. helium nuclei

J.J. Thomson proposed an atomic model that described the atom as a sphere

Select one:

- ☐ a. of positively charged and neutral particles about which negative charges orbit
- ☐ b. with a very dense positively charged nucleus surrounded by orbiting negative charges
- ☐ c. of positive electricity in which an equal amount of negative charge is distributed
- ☐ d. of positive electricity about which an equal amount of negative charges orbits

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Millikan's Experiment 1

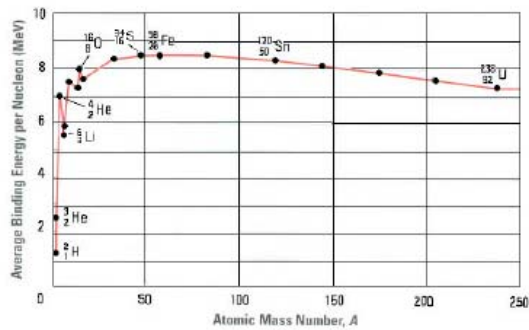
In a student experiment, a charge, q , on a plastic sphere of mass 7.2×10^{-16} kg, is suspended between two charged plates with a potential difference of 99 V and a plate separation of 4.5 mm.



Based on the evidence given in **Millikan's Experiment 1**, the number of electrons lost or gained by the plastic sphere is:

Select one:

- ☐ a. 2
- ☐ b. 20
- ☐ c. 30
- ☐ d. 3

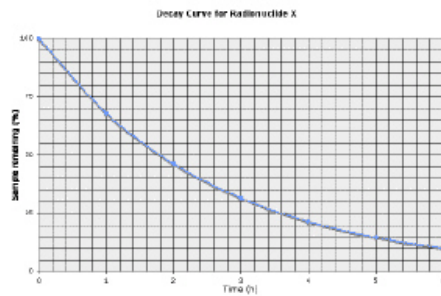


Based on the above graph, what is the binding energy for the Fe-56 nucleus?

Select one:

- ☐ a. 540 MeV
- ☐ b. 234 MeV
- ☐ c. 9.00 MeV
- ☐ d. 476 MeV

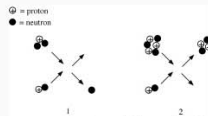
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Based on the above graph, what is the half-life of radionuclide X?

Select one:

- ☐ a. 0.8 hour
- ☐ b. 1.0 hour
- ☐ c. 2.0 hours
- ☐ d. 1.8 hours



The above diagrams represent possible nuclear fusion reactions. One of the reaction products is missing for each reaction. The missing product for reaction 1 is _____ and the missing product for reaction 2 is _____.

Select one:

- ☐ a. deuterium, helium
- ☐ b. tritium, lithium
- ☐ c. helium, lithium
- ☐ d. helium, helium

Scientists are able to determine the chemical composition of stars in the universe because

Select one:

- ☐ a. space probes are sent out to collect samples
- ☐ b. they collect and analyze material produced by the star
- ☐ c. all stars have the same chemical composition
- ☐ d. each chemical element has a unique line spectrum

The original fundamental particles included all of the following *except* the

Select one:

- ☐ a. neutron
- ☐ b. proton
- ☐ c. electron
- ☐ d. neutrino

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What is the daughter product for $^{247}_{96}\text{Cm}$ when it undergoes β^- decay?

Select one:

- ☐ a. $^{247}_{97}\text{Bk}$
- ☐ b. $^{243}_{94}\text{Pu}$
- ☐ c. $^{247}_{95}\text{Am}$
- ☐ d. $^{251}_{98}\text{Cf}$

When observing an emission line spectrum of a **hot gas**, some electrons in the atoms of the gas are believed to

Select one:

- ☐ a. move from a higher to a lower energy level
- ☐ b. jump from one atom to another
- ☐ c. combine in chemical reaction
- ☐ d. move from a lower to a higher energy level

Which of the following is the most accurate definition of mass defect?

Select one:

- ☐ a. mass of the product nuclei is less than the reactant nuclei of a nuclear reaction
- ☐ b. mass of the nucleons of a nucleus are greater than the mass of the nucleus
- ☐ c. mass of the nucleus is greater than the mass of its component nucleons
- ☐ d. mass of the reactant nuclei is less than mass of the product nuclei of a nuclear reaction

Which particle is used to cause the fission of U-235 in a typical nuclear reactor, such as the CANDU reactor?

Select one:

- ☐ a. a "slow" neutron
- ☐ b. a neutrino
- ☐ c. a proton
- ☐ d. a "fast" neutron

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The radioactive isotope carbon-14 is used to get an approximate age of archeological artifacts due to its long half-life of 5500 years. A typical sample of carbon-14 has an activity rating of 824 emissions per gram per hour. A sample of ancient pottery has a measured carbon-14 emission rate of 25.75 emissions per gram per hour. The pottery sample must be close to ...

a.bc x 10^d years old. ? (2 mks) Record your 4 digit abcd answer with no negative sign or decimal

Answer:

The radioactive isotope $^{212}_{84}\text{Po}$ undergoes α -decay. The energy released to the environment, expressed in scientific notation, is **a.bc** $\times 10^d$ eV. The values of **a**, **b**, **c**, and **d** are , _____, _____ and _____ (Use 3 sig digs) (2 mks) **Record your 4 digit abcd answer with no decimal**

mass Po - 212 = 212.035 amu

mass He - 4 (alpha) = 4.003 amu

mass Pb - 208 = 207.989 amu