

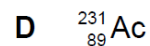
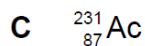
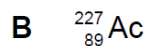
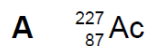
## Particle Physics – 2021 AS

### 1. June/2021/Paper\_11/No.39

A nucleus of uranium,  ${}_{92}^{235}\text{U}$ , undergoes a series of decays. During the series of decays, two  $\alpha$ -particles and one  $\beta^-$  particle are emitted.

As a result, a nucleus of actinium, Ac, is formed.

What is the correct notation for the nuclide of actinium that is formed?



### 2. June/2021/Paper\_11/No.40

Which particle is a fundamental particle?

A electron

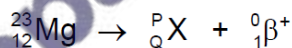
B hadron

C neutron

D proton

### 3. June/2021/Paper\_12/No.39

A nucleus of magnesium decays into a nucleus X by emitting a  $\beta^+$  particle. The decay is represented by the equation shown.



What are the values of P and Q?

	P	Q
A	22	11
B	22	13
C	23	11
D	23	13

4. June/2021/Paper\_12/No.40

In  $\beta^-$  decay, a neutron inside a nucleus changes to a proton.

Which statement describes the quark composition of the nucleus during the decay?

- A The number of down quarks decreases by one.
- B The number of down quarks increases by one.
- C The number of down quarks stays the same.
- D The number of up quarks stays the same.

5. Nov/2021/Paper\_11/No.39

A uranium-238 nucleus,  ${}_{92}^{238}\text{U}$ , undergoes a series of nuclear decays to form uranium-234,  ${}_{92}^{234}\text{U}$ .

Which series of decays could give this result?

- A emission of four  $\beta^-$  particles
- B emission of four  $\gamma$ -rays
- C emission of one  $\alpha$ -particle and two  $\beta^-$  particles
- D emission of two  $\alpha$ -particles and eight  $\beta^-$  particles

6. Nov/2021/Paper\_11/No.40

Which combination of up (u) and down (d) quarks forms a proton?

- A u u u                      B u u d                      C u d d                      D d d d

7. Nov/2021/Paper\_12/No.39

An unstable nucleus decays by emitting a  $\beta^+$  particle.

Which statement is correct?

- A An antineutrino is also emitted.
- B A neutron changes into a proton.
- C Mass–energy is conserved.
- D The nucleon number is not conserved.

8. Nov/2021/Paper\_12/No.40

Which statement is **not** correct?

- A An antineutrino is a fundamental particle.
- B An electron is made up of a quark and an antiquark.
- C A neutrino is a lepton.
- D A neutron is composed of three quarks.

9. Nov/2021/Paper\_13/No.38

When  $\alpha$ -particles are fired at a thin metal foil, most of the particles pass straight through but a few are deflected by a large angle.

Which change would increase the **proportion** of  $\alpha$ -particles deflected by a large angle?

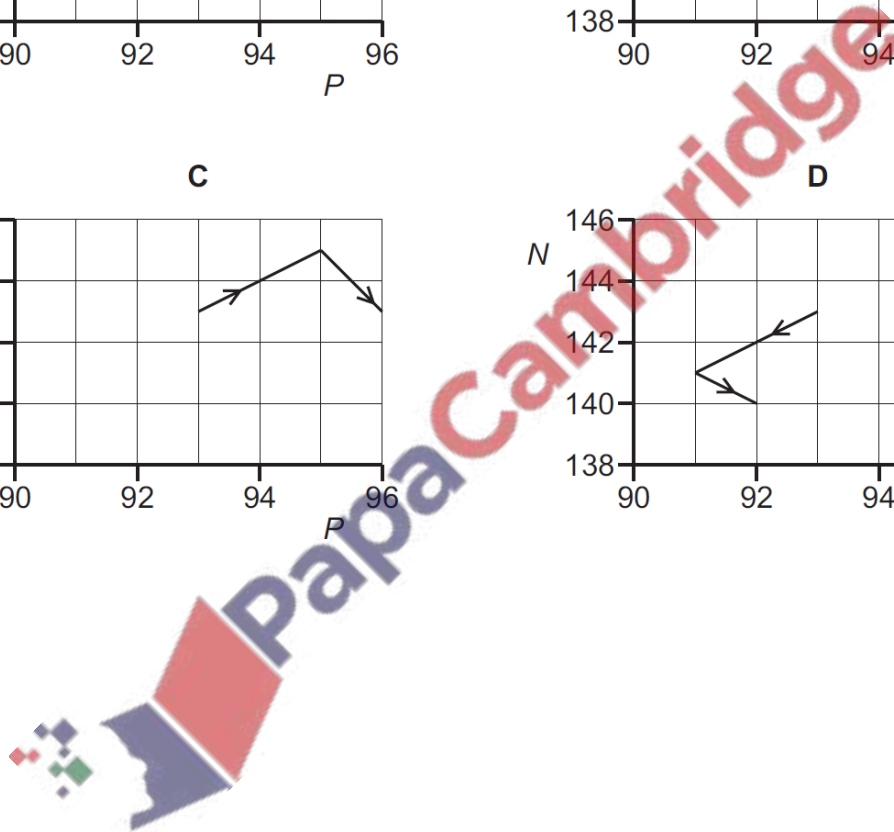
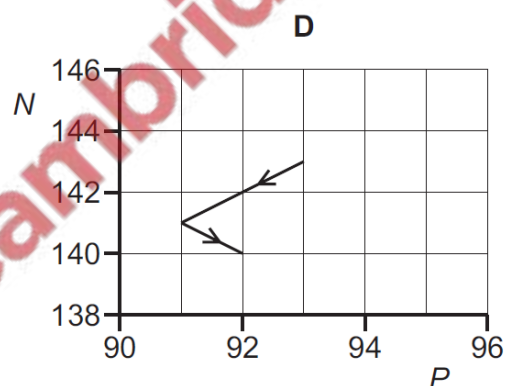
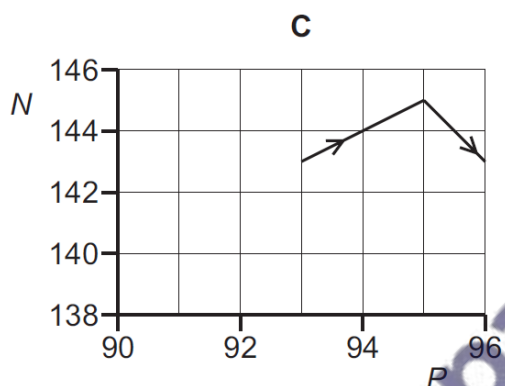
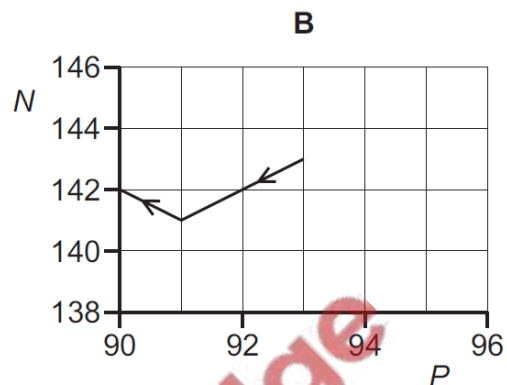
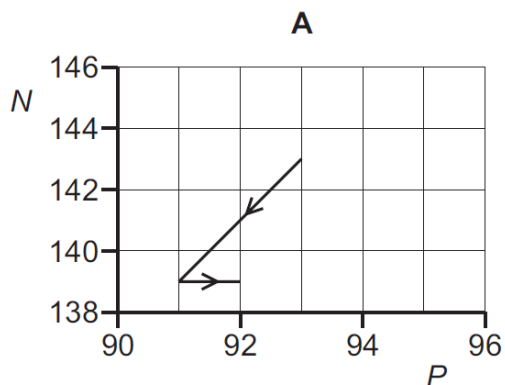
- A using  $\alpha$ -particles with greater kinetic energy
- B using a double thickness foil
- C using a foil made of a metal with fewer protons in its nuclei
- D using a source emitting more  $\alpha$ -particles per unit time



10. Nov/2021/Paper\_13/No.39

A nucleus of neptunium-236 contains 93 protons and 143 neutrons. This nucleus decays with the emission of an  $\alpha$ -particle. The nucleus formed then emits a  $\beta^-$  particle.

Which diagram shows the changes in the number  $P$  of protons and the number  $N$  of neutrons in these nuclei?



Which combination of quarks could **not** be the quark composition of the hadron shown?

p = proton

n = neutron

$\Sigma^-$  = sigma particle of charge  $-e$

$\Sigma^+$  = sigma particle of charge  $+e$

u = up quark

d = down quark

s = strange quark

	hadron	quark composition
<b>A</b>	$\Sigma^-$	dds
<b>B</b>	$\Sigma^+$	uds
<b>C</b>	p	uud
<b>D</b>	n	udd

