OCR
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A level Physics B

H557/01 Fundamentals of physics

Question Set 4 (Module 6 MCQs)

1. Which of the following changes doubles the flux in a magnetic circuit?

1 doubling the permeance

2 doubling the current-turns

3 halving the circuit length

A 1, 2 and 3 are correct

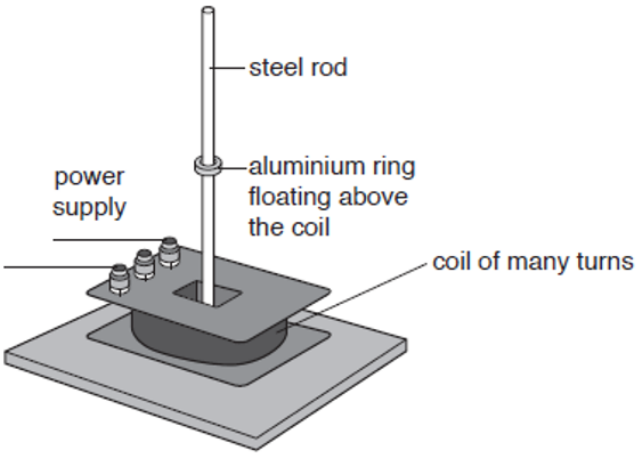
B only 1 and 2 are correct

C only 2 and 3 are correct

D only 1 is correct

[1]

2 An aluminium ring is free to move on a steel rod.
When the power supply is on, the ring floats.



Which of the following is correct?

A An a.c. or d.c. power supply can be used.

B The induced current in the ring is in the same direction as the current in the coil.

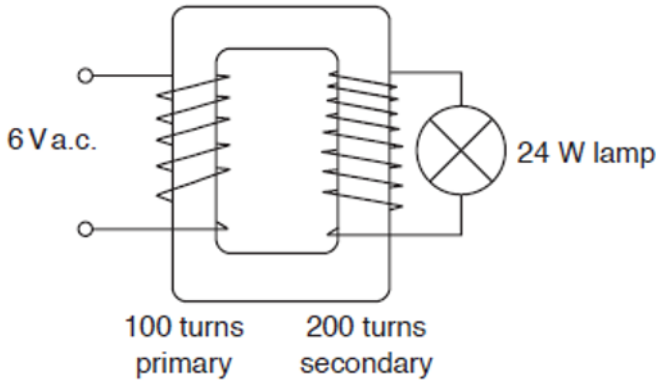
C The only purpose of the steel rod is to support the ring.

D When the ring is pushed down towards the coil more flux links it and the induced current increases.

[1]

3

A 6 V a.c. supply is connected to the 100 turn primary coil of an ideal transformer. The 200 turn secondary coil runs a lamp which dissipates 24 W.



Which is the best estimate of the current in the secondary coil?

A $\frac{1}{4}$ A

B $\frac{1}{2}$ A

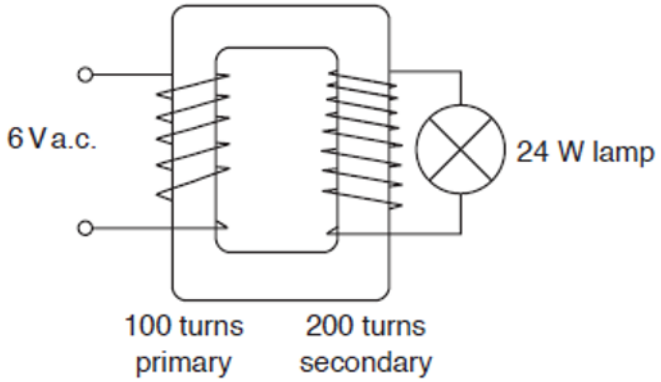
C 2 A

D 4 A

[1]

4

A 6 V a.c. supply is connected to the 100 turn primary coil of an ideal transformer. The 200 turn secondary coil runs a lamp which dissipates 24 W.



Which is the best estimate of the current in the primary coil?

A $\frac{1}{4}$ A

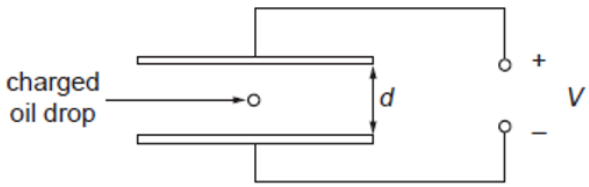
B $\frac{1}{2}$ A

C 2 A

D 4 A

[1]

5 An oil drop of mass m charged by one electron is balanced between two parallel horizontal metal plates. A potential difference V is applied between the plates as shown.



Which expression shows the balanced electrical and gravitational forces acting?

A $eVd = mg$

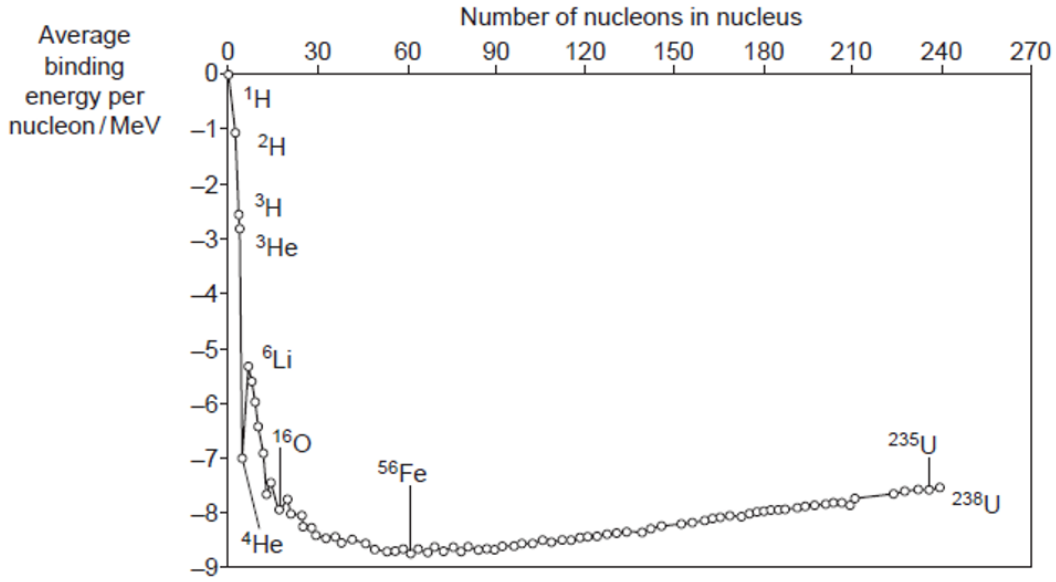
B $\frac{eV}{d} = mg$

C $\frac{V}{ed} = mg$

D $\frac{dV}{e} = mg$

[1]

6 The graph shows how the binding energy per nucleon varies with the nucleon number for stable nuclei.



Which **one** of the following statements is correct?

A All unstable nuclei have less binding energy than stable nuclei.

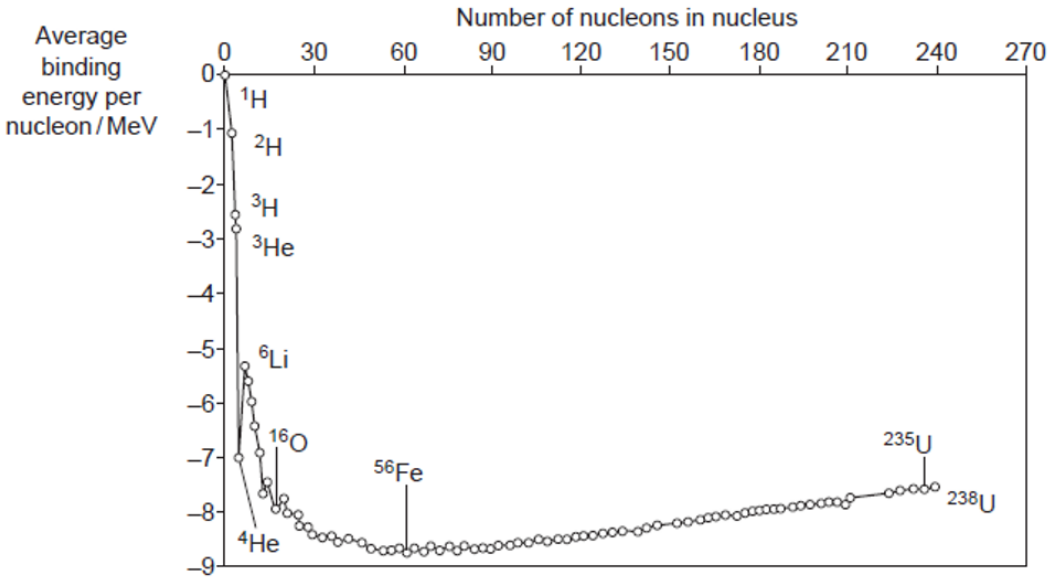
B ^{56}Fe requires less energy per nucleon than other stable nuclei to pull it apart into individual nucleons.

C Binding energy can be released in the fission of some heavy elements

D Binding energy is the energy released when a nucleus breaks down into individual nucleons.

[1]

7 The graph shows how the binding energy per nucleon varies with the nucleon number for stable nuclei.



Which is the best estimate for the total binding energy for a nucleus of $^{16}_{8}$O (Oxygen)?

A – 10 pJ

B – 20 pJ

C – 64 pJ

D – 128 pJ

[1]

8 Isotopes of a given element all have the same

A proton number.

B charge / mass ratio.

C neutron number.

D nucleon number.

[1]

9 $^{214}_{82}Pb$ decays by a series of transformations to a final stable product.

The particles emitted are: β, β, α, β, β, α.

Which one of the isotopes below is the final product?

A $^{206}_{82}Pb$

B $^{210}_{82}Pb$

C $^{208}_{83}Bi$

D $^{214}_{83}Bi$

[1]

10 An electron is travelling at a speed of $3.1 \times 10^5 \, m\,s^{-1}$.

What is its kinetic energy in electronvolts?

A 4.4×10^{-20} eV

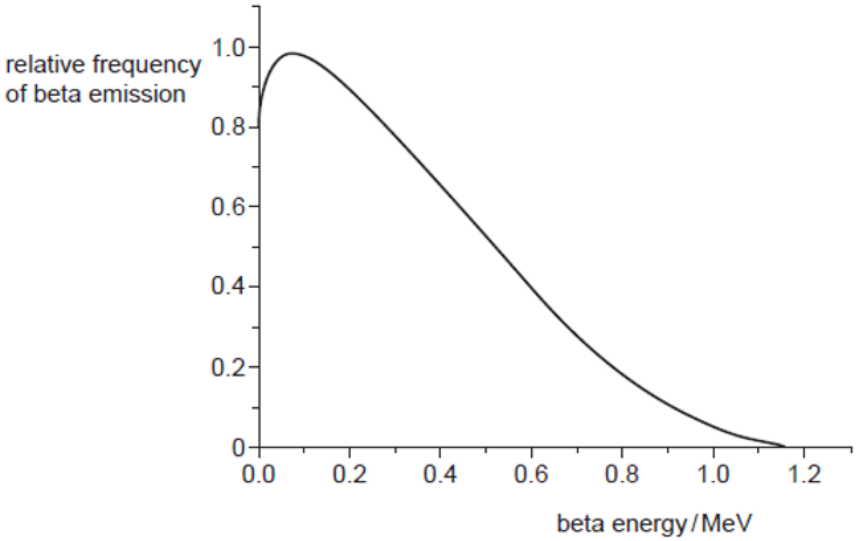
B 8.8×10^{-7} eV

C 0.27 eV

D 500 eV

[1]

11 The diagram shows the beta energy spectrum for emissions from a radioactive isotope.



Which statement is correct?

A The maximum energy of beta emissions is about 0.1 MeV.

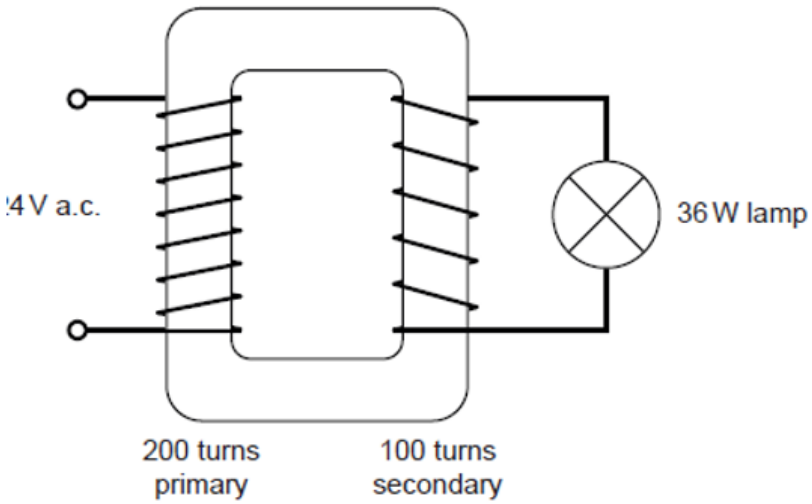
B More than half the beta particles are emitted with less than half the maximum energy.

C The "missing energy" in beta emissions is taken by the recoiling nucleus.

D The most frequent energy of beta emission is about 1.16 MeV.

[1]

12 A transformer runs a 36.0 W lamp from a 24.0 V a.c. supply.



What is the current in the secondary coil?

A 1.5A

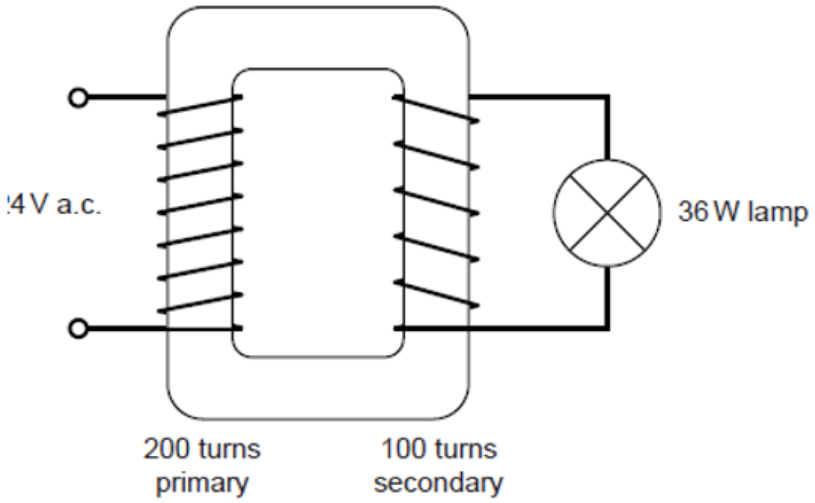
B 3.0A

C 4.0A

D 6.0A

[1]

13 A transformer runs a 36.0 W lamp from a 24.0 V a.c. supply.



What is the best estimate for the rate of change of flux in the transformer core?

A $0.12\,\text{Wb s}^{-1}$

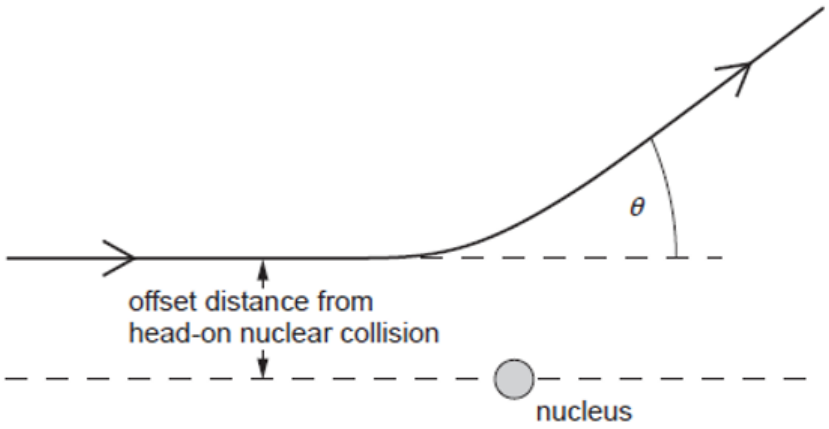
B $0.12\,\text{T m}^{-2}\text{s}^{-1}$

C $12\,\text{Wb s}^{-1}$

D $12\,\text{T m}^{-2}\text{s}^{-1}$

[1]

14 An α particle approaches an atomic nucleus and is scattered through angle θ. The path of the particle is offset as shown.



Which change on its own would cause the scattering angle θ to increase?

A Use an α particle with higher kinetic energy.

B Have a smaller offset distance for the initial trajectory.

C Use a target nucleus with a smaller charge.

D Use a target nucleus with a smaller mass.

[1]

15 A particle of charge q and mass m travels in a vacuum in a region of constant magnetic flux density B.
It moves at a constant speed v in a circle of radius r.

Which expression gives the time for the particle to complete one circle of its m

A $\frac{2\pi m}{Bqr}$

B $\frac{2\pi mr}{Bq}$

C $\frac{2\pi m}{Bq}$

D $\frac{Bq}{2\pi m}$

[1]

16 A particle of charge q and mass m travels in a vacuum in a region of constant magnetic flux density B.
It moves at a constant speed v in a circle of radius r.

A proton and an α particle, with the same velocity, enter the region of constant magnetic flux density.

What is the ratio of the radii of their paths, $\frac{r_\alpha}{r_{proton}}$?

A $\frac{1}{4}$

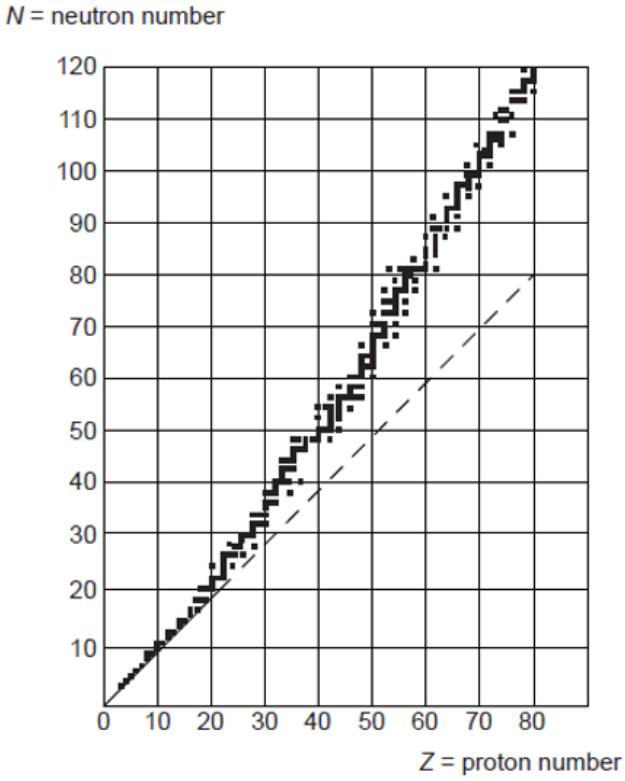
B $\frac{1}{2}$

C 2

D 4

[1]

17 The graph shows neutron number N plotted against proton number Z for stable nuclei.



Which statement about stable nuclei is correct?

Which statement about stable nuclei is correct?

A For elements up to about $Z = 50$ $N \approx Z$.

B Elements with $Z \approx 80$ have more protons than neutrons.

C Greater $\frac{N}{Z}$ ratio is needed to hold larger nuclei together, because only neutrons take part in the strong nuclear force of attraction to balance electrostatic repulsion.

D Greater $\frac{N}{Z}$ ratio is needed to hold larger nuclei together because only nearest neighbour nucleons take part in the strong nuclear force of attraction to balance electrostatic repulsion. **[1]**

18 The electric potential at a distance r from a positive point charge Q is 450 V.
The potential increases to 500 V when the distance from the point charge decreases by 1.5 m.

What is the value of r?

A 1.5 m

B 7.9 m

C 15 m

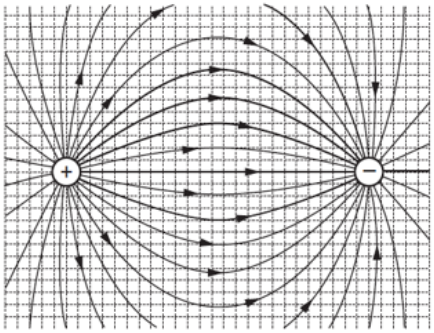
D 29 m

[1]

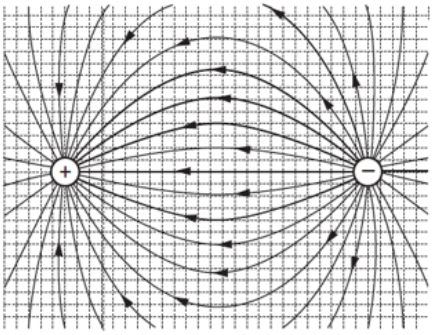
19 A positive and a negative charge of equal magnitude are placed near each other.

Which diagram best represents the electric field of the two charges?

A



B



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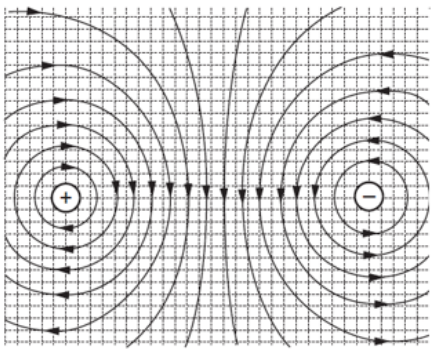
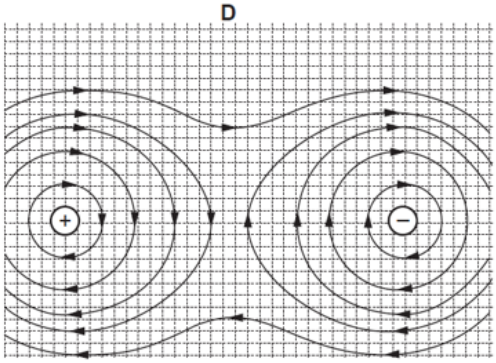
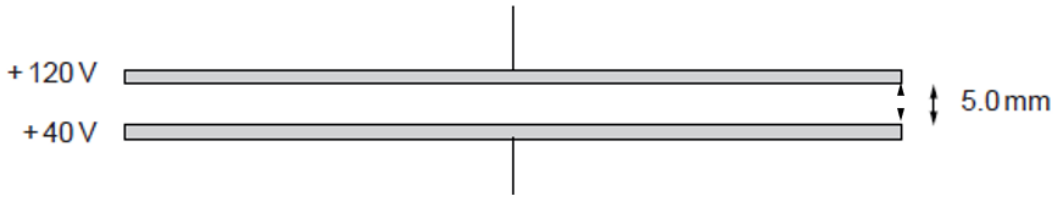


D



[1]

20 Two horizontal metal plates are 5.0 mm apart.
The plates are at potentials of +120 V and +40 V.



What is the force experienced by an electron in the electric field between the plates?

A 2.6×10^{-18} N

B 5.1×10^{-18} N

C 2.6×10^{-15} N

D 5.1×10^{-15} N

[1]

21 Protons consist of quarks.

The 'up' anti-quark has a charge of $-\frac{2e}{3}$ and the 'down' anti-quark has a charge of $+\frac{1e}{3}$, where e is the charge on an electron.

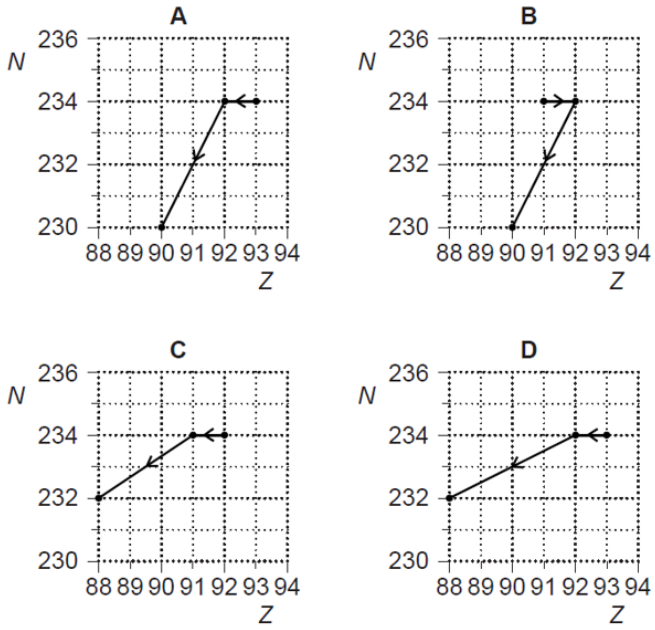
What does an **anti-proton** contain?

	Up anti-quarks	Down anti-quarks
A	0	3
B	1	1
C	1	2
D	2	1

[1]

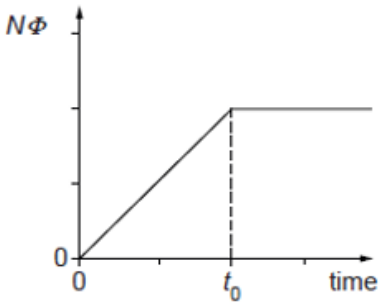
22 A radioactive nucleus is formed by β-decay. This nucleus then decays by α-emission.

Which graph of nucleon number N plotted against proton number Z shows the β-decay followed by the α-emission?



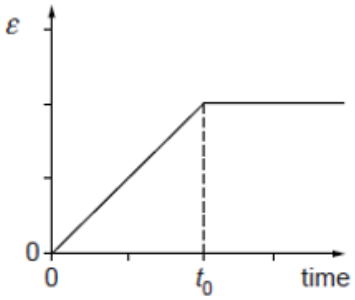
[1]

23 The graph shows how the flux linkage $N\Phi$ through a coil changes with time when the coil is moved into a magnetic field.

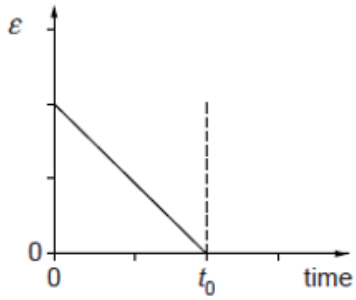


Which of the following graphs shows the magnitude of the induced e.m.f. ε in the coil over the same time period?

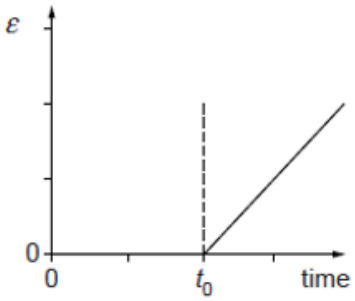
A



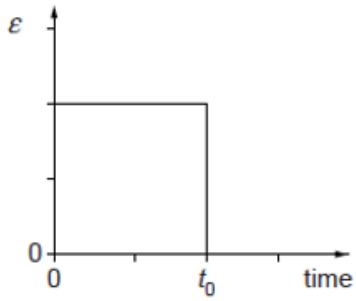
B



C

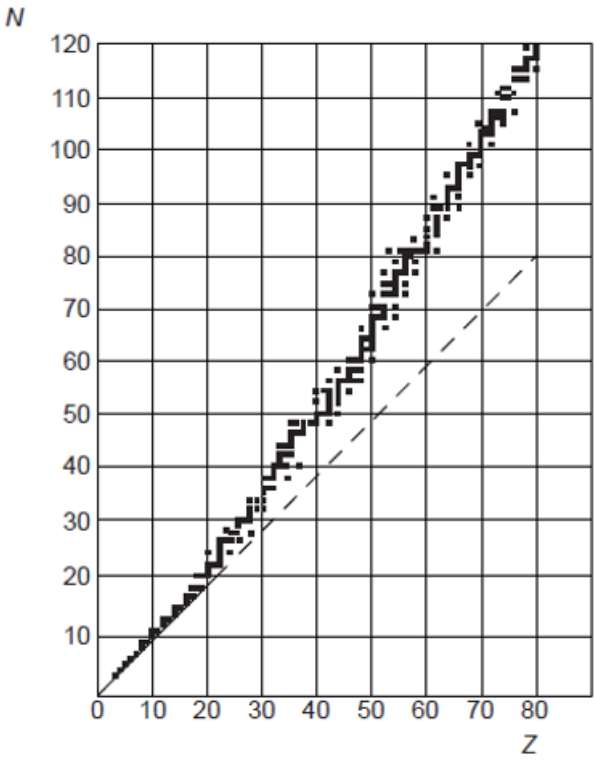


D



[1]

24 The graph shows neutron number N plotted against proton number Z for stable nuclei.



Which statements about stable nuclei are correct?

1 Nuclei of elements with $Z > 20$ have more protons than neutrons.

2 For the nuclei of lighter elements $N \approx Z$.

3 Greater $\frac{N}{Z}$ ratio is needed to hold larger nuclei together, because only nearest neighbour nucleons take part in the strong nuclear force of attraction to balance electrostatic repulsion.

A 1, 2 and 3 are correct

B only 1 and 2 are correct

C only 2 and 3 are correct

D only 1 is correct

[1]

Total Marks for Question Set 4: 24

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