

## 7.2 Nuclear Reactions

# **Question Paper**

Course	DP IB Physics	
Section	7. Atomic, Nuclear & Particle Physics	
Topic	7.2 Nuclear Reactions	
Difficulty	Easy	

Time allowed: 20

Score: /10

Percentage: /100



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#### Question 1

Which of the following is the best definition of the unified atomic mass unit?

- A. A unit of mass which is equal to the mass of one-twelfth of a neutral carbon-12 atom
- B. A unit of mass which is equal to the mass of half of a carbon-12 atom
- C. A unit of mass which is equal to the mass of twelve grams of a neutral carbon-12 atom
- D. A unit of mass which is equal to twice the mass of a neutral carbon-12 atom

[1 mark]

## Question 2

Energy-mass equivalence is given by  $\Delta E = \Delta mc^2$ .

Using the given equation, determine which of the following is a valid unit of mass.

- A. MeV
- B.  $\frac{MeV}{c}$
- C.  $\frac{MeV}{c^2}$
- $\operatorname{D.} \operatorname{eV}$

[1 mark]

#### Question 3

The average binding energy per nucleon of Neon–20  $\binom{20}{10}$  Ne) nucleus is 8.0 MeV.

What is the total energy required to separate the nucleons of one nucleus of  $^{20}_{10}$ Ne?

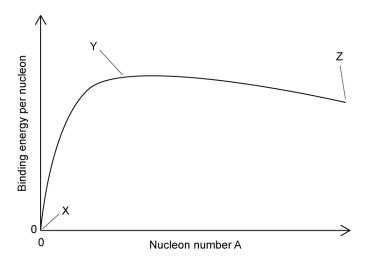
- A. O MeV
- B.8 MeV
- C.160 MeV
- D. 800 MeV



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#### Question 4

The graph shows the binding energy per nucleon against nucleon number.



Which row in the table gives possible elements found on the graph at positions X, Y and Z?

	X	Y	Z
A.	Uranium	Calcium	Xenon
B.	Hydrogen	Uranium	Iron
C.	Calcium	Hydrogen	Iron
D.	Hydrogen	Iron	Uranium

[1 mark]

#### Question 5

Which statement is correct regarding nuclear fission?

- A. The daughter nucleus has a greater nucleon number than the original nucleus
- B. Energy is absorbed during nuclear fission
- C. The combined mass of the daughter nuclei is less than the mass of the original nucleus
- D. Nuclear fission is the joining of two small nuclei to produce a larger nucleus



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## Question 6

What is the approximate mass of oxygen-16  ${16 \choose 8}$  in atomic mass units?

- A.1u
- B. 8 u
- C.16 u
- $D.3.00 \times 10^{8} u$

[1 mark]

#### Question 7

Nuclear reactions can be represented by equations.

$$^{235}_{92}$$
U +  $^{1}_{0}$ n  $\rightarrow$  2  $^{116}_{46}$ Pd + 4  $^{1}_{0}$ n

Which type of reaction does the equation show?

- A. Alpha decay
- B. Beta decay
- C. Nuclear fusion
- D. Nuclear fission

[1 mark]

#### Question 8

A nuclide of deuterium  $^2_1H$  and a nuclide of tritium  $^3_1H$  undergo nuclear fusion.

Which statement is not correct about nuclear fusion?

- A. For fusion to occur both nuclei must have high kinetic energy
- B. The process of fusion absorbs energy
- C. Fusion is the combining of two smaller nuclei into a larger nucleus
- D. Fusion is the process that powers stars



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## Question 9

Which statement is a definition of binding energy per nucleon?

- A. The difference between an atom's mass and the sum of the masses of its nucleons
- B. The binding energy of a nucleus divided by the number of nucleons in the nucleus
- C. The energy required to break a nucleus into its constituent protons and neutrons
- D. The amount of kinetic energy required for fusion to occur

[1 mark]

## **Question 10**

The following fusion reaction occurs in stars:

$${}_{1}^{2}H + {}_{1}^{3}H \rightarrow {}_{2}^{4}He + {}_{0}^{1}n$$

The binding energies are given as follows:

- The binding energy of deuterium,  ${}_{1}^{2}\mathrm{H}$  is 2.2 MeV
- The binding energy of tritium,  $^3_1H$  is 8.5 MeV
- The binding energy of helium,  $^4_2\mathrm{He}$  is 7.1 MeV

Given that the energy released is the difference between the binding energy of the products and the reactants, how much energy is released in this fusion process?

- A. 2.2 MeV
- B. 3.6 MeV
- C.7.1 MeV
- D.10.7 MeV