

7.1 Discrete Energy & Radioactivity

Question Paper

Course	DP IB Physics	
Section	7. Atomic, Nuclear & Particle Physics	
Topic	7.1 Discrete Energy & Radioactivity	
Difficulty	Easy	

Time allowed: 20

Score: /10

Percentage: /100

Question 1

Which of the statements is the correct definition of excitation of an electron?

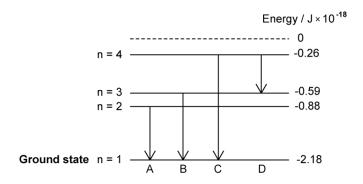
- A. When an electron is removed from or added to an atom
- B. When an electron moves down an energy level emitting a photon
- C. When an electron is given enough energy to move up an energy level, but not enough to leave the atom
- D. When an electron is given enough energy to move up an energy level, and sometimes leave the atom

[1 mark]

Question 2

The diagram below shows the energy levels of a mercury atom.

Which transition produces a photon with the longest wavelength?





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Question 3

The diagram shows an energy-level diagram for a hydrogen atom.

-3.4 eV

How many discrete photon energies could be produced from these energy levels?

- A. 3
- B. 5
- C.6
- D.7

[1 mark]

Question 4

Which of the following is not a feature of an emission spectrum?

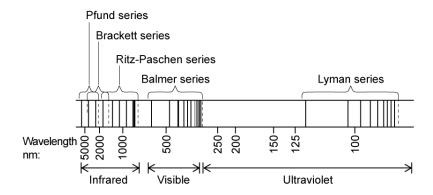
- A. When an electron transitions from a higher energy level to a lower energy level, this results in the emission of a photon
- B. An emission spectrum contains a set of discrete wavelengths, represented by coloured lines on a black background
- C. An emission spectrum is evidence to show that electrons in atoms can only transition between discrete energy levels
- D. An emission spectrum consists of a continuous spectrum containing all the colours with dark lines at certain wavelengths



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Question 5

A larger version of the hydrogen emission spectrum from the infrared to the ultraviolet region looks as follows:



Using information in the diagram, which hydrogen series corresponds to the highest energy photons being emitted?

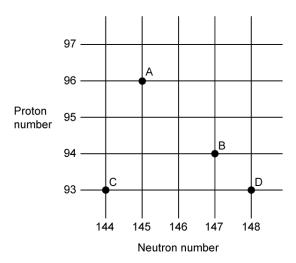
- A. Lyman series
- B. Balmer series
- C. Brackett series
- D. Pfund series

[1 mark]

Question 6

An isotope of $^{241}_{95}\,\mathrm{Am}\,$ undergoes alpha-decay.

Which letter on the N-Z graph below represents the correct proton-neutron product of the decay?



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Question 7

Uranium-238 undergoes radioactive decay to become Thorium-234. A second decay occurs and the product is protactinium-234.

The decay sequence can be represented in equation form, where i, j and k are particles.:

$$^{238}_{92}{\rm U} \rightarrow ^{234}_{90}{\rm Th} \, + \, i$$

$$^{234}_{90}$$
Th $\rightarrow ^{234}_{91}$ Pa + j + k

What are the correct names of these particles?

	i	j	k
Α	alpha	beta-minus	electron anti-neutrino
В	beta-positive	beta-minus	alpha
С	beta-minus	neutron	photon
D	alpha	beta-positive	neutron

[1 mark]

Question 8

What are the correct numbers of protons, neutrons and electrons in a neutral atom of $^{234}_{92}U$?

	protons	neutrons	electrons
Α	92	92	92
В	92	142	92
С	142	92	142
D	234	142	92



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Question 9

What is the charge on, and mass of, an electron neutrino and during what process is an electron neutrino produced?

	charge/e	mass/u	production of neutrino
Α	+1	zero	during β ⁺ emission
В	-1	+1	during β ⁻ emission
С	zero	zero	during β ⁺ emission
D	zero	0.0005	during β ⁻ emission

[1 mark]

Question 10

A sample of californium-239 has an activity of 4000 Bq. The half-life of californium-239 is 1 minute.

What will the activity be after 4 minutes?

- A. 4000 Bq
- B.1000 Bq
- C.500Bq
- D. 250 Bq