

7.1 Discrete Energy & Radioactivity

Question Paper

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

Time allowed: 20
Score: /10
Percentage: /100

Question 1

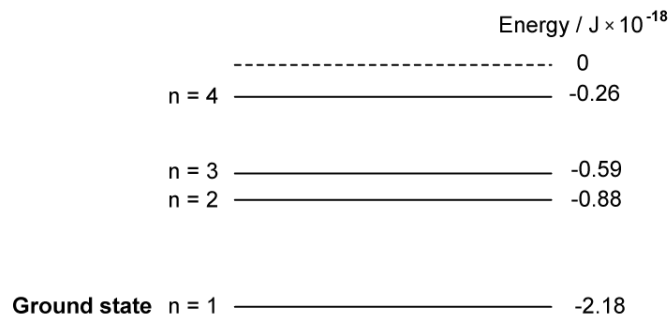
Which of the statements is the correct definition of excitation of an electron?

- 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

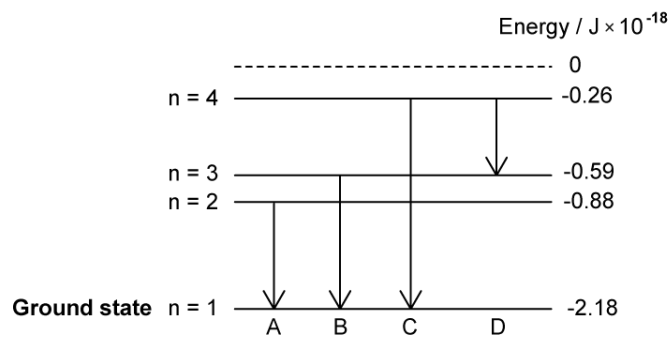
[1 mark]

Question 2

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



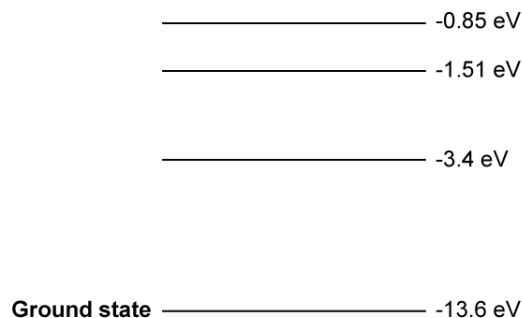
Which transition produces a photon with the **longest** wavelength?



[1 mark]

Question 3

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



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

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

[1 mark]

Question 4

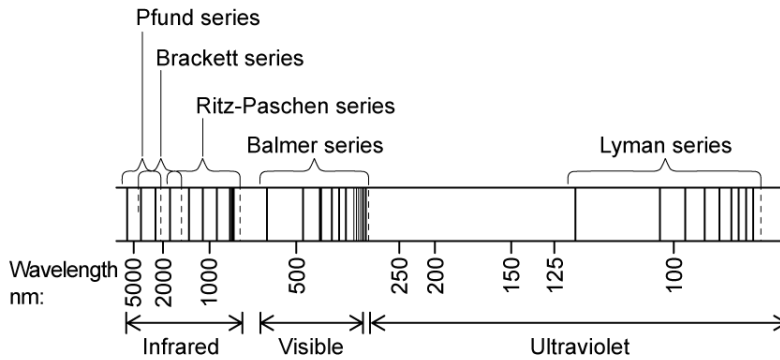
Which of the following is not a feature of an emission spectrum?

- 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

[1 mark]

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?

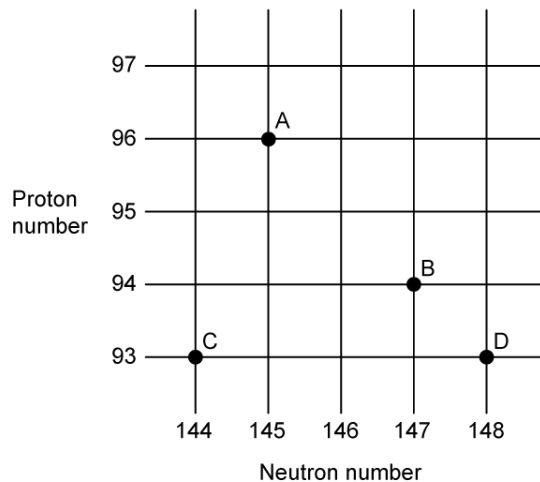
- A. Lyman series
- B. Balmer series
- C. Brackett series
- D. Pfund series

[1 mark]

Question 6

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

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

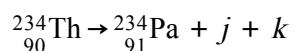
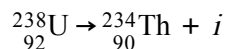


[1 mark]

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.:



What are the correct names of these particles?

	i	j	k
A	alpha	beta-minus	electron anti-neutrino
B	beta-positive	beta-minus	alpha
C	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 ${}_{92}^{234}\text{U}$?

	protons	neutrons	electrons
A	92	92	92
B	92	142	92
C	142	92	142
D	234	142	92

[1 mark]

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
A	+1	zero	during β^+ emission
B	-1	+1	during β^- emission
C	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. 500 Bq
- D. 250 Bq

[1 mark]