



Name _____ Form _____

Q1. What are the numbers of hadrons, baryons and mesons in an atom of ${}^7\text{Li}$?

	hadrons	baryons	mesons	
A	7	3	3	<input type="checkbox"/>
B	7	4	4	<input type="checkbox"/>
C	7	7	0	<input type="checkbox"/>
D	10	7	0	<input type="checkbox"/>

Q2. A radioactive nucleus emits a β^- particle then an α particle and finally another β^- particle. The final nuclide is

- A an isotope of the original element
- B the same element with a different proton number
- C a new element of higher proton number
- D a new element of lower nucleon number

Q3. The nucleus of ${}^9_4\text{Be}$ captures a proton and emits an α particle. What is the product nucleus?

- A ${}^{10}_6\text{C}$
- B ${}^7_3\text{Li}$
- C ${}^6_3\text{Li}$
- D ${}^6_2\text{He}$

Q4. Electron capture can be represented by the equation: $p + e^- \rightarrow X + Y$

Which row correctly identifies X and Y?

	X	Y	
A	p	K^-	<input type="checkbox"/>
B	e^-	e^+	<input type="checkbox"/>
C	n	V_e	<input type="checkbox"/>
D	n	π^0	<input type="checkbox"/>



Q5. A calcium ion is formed by removing two electrons from an atom of ${}^{40}_{20}\text{Ca}$. What is the specific charge of the calcium ion?

A $3.2 \times 10^{-19} \text{ C kg}^{-1}$

B $2.9 \times 10^{-18} \text{ C kg}^{-1}$

C $4.8 \times 10^6 \text{ C kg}^{-1}$

D $4.8 \times 10^7 \text{ C kg}^{-1}$

(Total 5 Marks)

Q6. Mesons that contain a strange (or antistrange) quark are known as K-mesons or kaons. Mesons are a sub-group of a larger group of particles.

(a) (i) State the name of this larger group of particles.

.....

(1)

(ii) Determine the charge on a kaon with a quark structure of: up, anti-strange.

.....

(1)

(b) A proposed decay for this kaon is



(i) Apply the law of conservation of strangeness to the proposed decay.

.....
.....

(1)

(ii) Comment on whether or not this decay is possible.

.....
.....

(1)

(Total 4 marks)

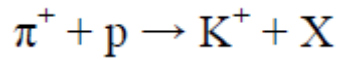
Q7.(a) Complete the table comparing some of the properties of the positive pion, π^+ , and the proton.

Name	π^+	Proton
Relative charge	+1	
Baryon number		
Quark composition		

(5)



- (b) When a positive pion interacts with a proton, a kaon can be produced, along with another strange particle, as shown in this equation



Circle the type of interaction shown in this equation.

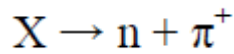
- Electromagnetic Gravitational Strong Nuclear Weak Nuclear

(1)

- (c) Deduce the relative charge, baryon number and strangeness of particle X.

(3)

- (d) Particle X can decay to produce a neutron and positive pion as shown in this equation



Circle the type of interaction shown in this equation.

- Electromagnetic Gravitational Strong Nuclear Weak Nuclear

(1)

- (e) Explain your answer.

.....

(2)

- (f) The neutron and positive pion will then decay. The positive pion can decay into a positron and an electron neutrino.

Write down the equation for the decay of the neutron.

(2)

- (g) Explain why no further decays occur.

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(2)

(Total 16 marks)

(Grand Total 25 marks)