FREE REVISION PACK

Fundamental Forces & Exchange Particles

AQA A-level Physics · 7407 / 7408 · Specification 3.2.1.4

Easy | Medium | Multiple choice · past-paper questions

5	5	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Electron capture: exchange particle and products	AQA June 2018 · AS Paper 2 · Q7	1 mark
2	Easy	Beta-plus decay diagram	AQA June 2017 · A-level Paper 1 · Q9	1 mark
3	Easy	Exchange particle in electron capture	AQA June 2023 · AS Paper 2 · Q15	1 mark
4	Easy	Beta-minus decay diagram	AQA June 2023 · A-level Paper 1 · Q11	1 mark
5	Medium	What exchange particles must have	AQA June 2023 · AS Paper 2 · Q23	1 mark

Key ideas to have ready

- Forces between particles are carried by **exchange particles**: virtual photon (electromagnetic), W^+ / W^- bosons (weak), gluons and pions (strong).
- The weak interaction changes quark type: in β^- decay d → u, and in β^+ decay and electron capture u → d.
- β^+ decay: p → n + e^+ + ν_e. Electron capture: p + e^- → n + ν_e. Both use a W^+.
- Charge is conserved at every vertex of a Feynman-style diagram, which tells you the sign of the W boson.

How to use this pack

1. The questions are grouped into levels (Easy and Medium). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in AQA's examiner reports where that information exists, plus our own difficulty rating. *About 1.5 minutes per question.

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Easy

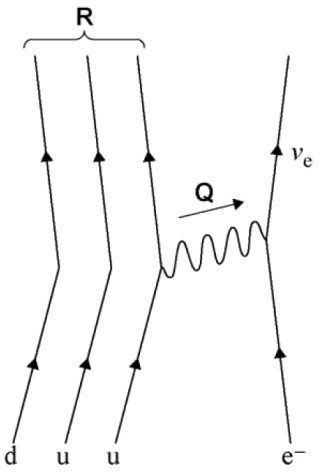
Definitions and one-step ideas. Most students get these right.

Questions 1–4

Only **one** answer per question is allowed. For each question, completely fill in the circle alongside the appropriate answer.

AQA June 2018 · AS Paper 2 · Q7

1 The partially completed diagram represents electron capture.



Which row identifies the exchange particle **Q** and the quark structure of particle **R**?

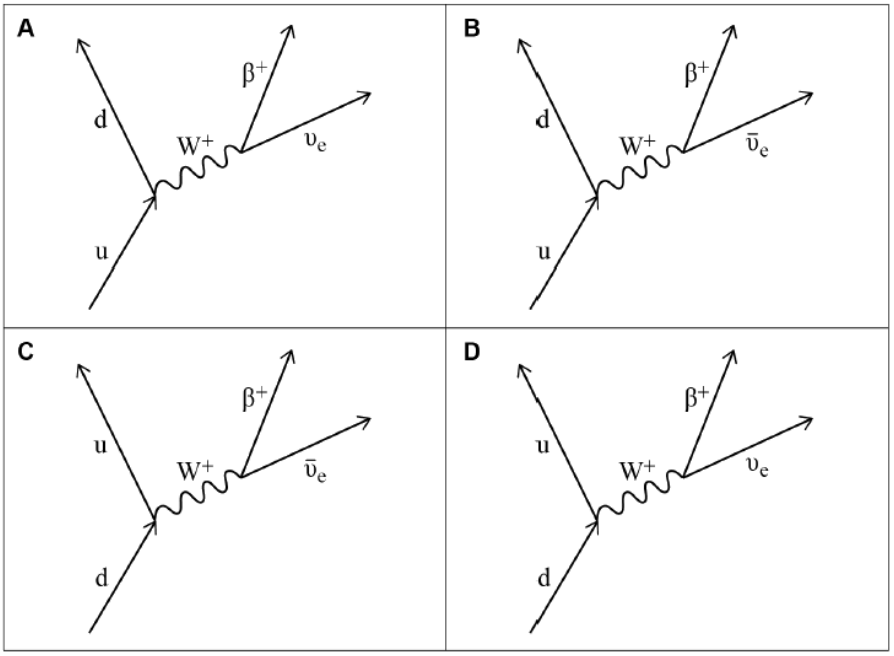
[1 mark]

	Particle Q	Quark structure of particle R	
A	W^-	uuu	⬭
B	W^+	dud	⬭
C	W^+	uuu	⬭
D	W^-	dud	⬭

AQA June 2017 · A-level Paper 1 · Q9

2 Which diagram represents the process of beta-plus decay?

[1 mark]



A ⬭

B ⬭

C ⬭

D ⬭

AQA June 2023 · AS Paper 2 · Q15

3 Which exchange particle transfers charge during electron capture?

[1 mark]

A meson ⬭

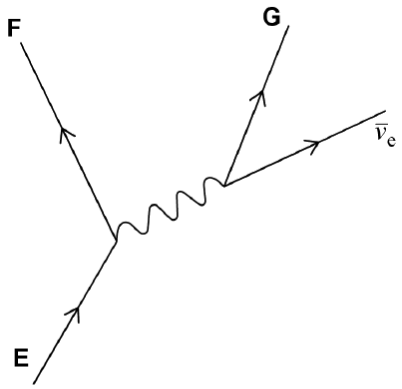
B pion ⬭

C virtual photon ⬭

D W boson ⬭

AQA June 2023 · A-level Paper 1 · Q11

4 The diagram represents a quark change in which an electron antineutrino is produced.



What are **E**, **F** and **G**?

[1 mark]

	E	F	G	
A	up quark	down quark	β^-	⬭
B	down quark	up quark	β^-	⬭
C	up quark	down quark	β^+	⬭
D	down quark	up quark	β^+	⬭

Medium Two or three steps. Roughly a third to a half of students get these right. **Question 5**

AQA June 2023 · AS Paper 2 · Q23

5 The concept of exchange particles was introduced to explain forces between elementary particles.

This concept requires that exchange particles have

[1 mark]

A charge. ⬭

B momentum. ⬭

C phase. ⬭

D rest mass. ⬭

End of questions. Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition:
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