

Revision Sheet

A-Level Physics · Unit 11 Particle physics

12 vocabulary items · 37 marks of exam questions (9 questions)

Part 1 · Vocabulary review answer key. Section A wants the exact English spelling.

Question	Answer	Marks
1	nucleus	1
2	proton	1
3	neutron	1
4	nuclide	1
5	proton number	1
6	nucleon number	1
7	nucleon	1
8	isotope	1
9	radioactive	1
10	antineutrino	1
11	neutrino	1
12	quark	1

Question 13 (Answer: **D**)

- Up, charm and top each carry $+\frac{2}{3}e$; down and strange each carry $-\frac{1}{3}e$.
- D gives $+\frac{2}{3} - \frac{1}{3} - \frac{1}{3} = 0$.
- A comes to $-1e$, B to $+1e$ and C to $+2e$.

Question 14 (Answer: **C**)

- Alpha decay is a two-body split, so the energy is shared one fixed way – giving discrete energies.
- Beta decay releases a third particle, a neutrino or antineutrino, alongside the beta particle.
- The available energy is divided between them in any proportion, so the beta energy varies continuously.

Multiple Choice Answers

Q15: D

Question 16 (Answer: **C**)

- A β^- particle shares the energy released with an antineutrino, so the β^- particles come out with a continuous range of kinetic energies: **C**.
- The α -particles from a given decay all carry the same discrete energy, so B is wrong, and no neutrino is emitted in α decay, so A is wrong.
- α decay lowers the proton number by 2, not 4, so D is wrong.

17(a)	down charge = $-1/3(e)$ and charm charge = $(+2/3)(e)$
	all antiquarks have opposite sign and same (non-zero) magnitude of charge as the corresponding quarks
17(b)(i)	udd or cdd
17(b)(ii)	$u\bar{d}$ or $c\bar{d}$
17(c)(i)	lepton(s)
17(c)(ii)	positron / neutrino / antineutrino

18(a)(i)	most of the atom is empty space <i>or</i> the nucleus (volume) is very small <u>compared to the atom</u>
18(a)(ii)	the nucleus is charged
	the mass is <u>concentrated</u> in nucleus / small region / small volume / small core <i>or</i> the <u>majority</u> of the mass is in nucleus / small region / small volume / small core
18(b)(i)	proton number = 84
	nucleon number = 214
18(b)(ii)	up down down changes to up up down / udd $\rightarrow$ uud <i>or</i> down changes to up / d $\rightarrow$ u

19(a)(i)	$P = 40$ and $R = 0$
	$Q = 20$ and $S = -1$
19(a)(ii)	(electron) antineutrino
19(a)(iii)	leptons
19(b)	(alpha particle consists of) 2 protons and 2 neutrons
	quark composition of proton = up up down or quark composition of neutron = up down down
	quark composition (of alpha particle) = 6 up, 6 down

20(a)(i)	${}^{18}_9\text{F} \rightarrow {}^{18}_8\text{O} + {}^{0}_{(+1)}\beta^{(+)} + {}^{(0)}_{(0)}\nu_{(e)}$
	ν or neutrino (B1)
	${}^{0}_{(+1)}\beta^{(+)}$ (B1)
	${}^{18}_8\text{O}$ (B1)
20(a)(ii)	up quark to down quark
20(b)(i)	must be three (anti)quarks as largest (negative) quark charge is $(-)\frac{2}{3}(e)$
	or
	mesons can only have a charge of 0 or $\pm 1(e)$
20(b)(ii)	(so hadron is) a baryon
	any combination of three from:
	antiup (quark) / up antiquark and/or anticharm (quark) / charm antiquark and/or antitop (quark) / top antiquark

21(a)(i)	change in $A = 0$
	change in $Z = (+)1$
21(a)(ii)	(electron) <u>anti</u> neutrino
21(b)(i)	up / u (charge) = $(+)\frac{2}{3}e$ or antidown / $\bar{d} = (+)\frac{1}{3}e$
	or
	$(q) = \frac{2}{3}e + \frac{1}{3}e$
21(b)(ii)	$q = (+)1e$
	hadron(s)
	meson(s)