

## AQA 1 Answers – The Atom and Specific Charge (set 2)

### June 12 Q2

2	a	ii	$14 - 6 = 8 \checkmark$	1						
2	a	iii	specific charge $= 6 \times 1.6 \times 10^{-19} \checkmark / (14 \times 1.66 \times 10^{-27} \checkmark)$ specific charge $= 4.1 \times 10^7 \text{ (C kg}^{-1}) \checkmark$	3						
2	b	i	isotopes are variations of an element that have same proton/atomic number $\checkmark$ but different nucleon number OR different number of neutrons $\checkmark$	2						
2	b	ii	$4.8 \times 10^7 = 6 \times 1.6 \times 10^{-19} \checkmark / (A \times 1.66 \times 10^{-27})$ $A = 6 \times 1.6 \times 10^{-19} / (4.8 \times 10^7 \times 1.66 \times 10^{-27})$ $A = 12 \checkmark$ Number of neutrons $= 12 - 6 \checkmark$	3						
3	a		<table><tr><td>interaction</td><td>exchange particle</td></tr><tr><td>weak</td><td><math>W^+</math> OR <math>W^-</math> OR <math>Z^0 \checkmark</math></td></tr><tr><td>electromagnetic</td><td>photon OR <math>\gamma \checkmark</math></td></tr></table>	interaction	exchange particle	weak	$W^+$ OR $W^-$ OR $Z^0 \checkmark$	electromagnetic	photon OR $\gamma \checkmark$	2
interaction	exchange particle									
weak	$W^+$ OR $W^-$ OR $Z^0 \checkmark$									
electromagnetic	photon OR $\gamma \checkmark$									

### Jan 13 Q1

1	a	(i)	neutron ✓	1	accept symbols symbols e.g. n
1	a	(ii)	electron ✓	1	accept symbols
1	a	(iii)	neutron ✓	1	accept symbols
1	b	(i)	antineutrino ✓	1	$\bar{\nu}_{(e)}$
1	b	(ii)	$A = 99$ ✓ $Z = 44$ ✓	2	
1	b	(iii)	specific charge = $43 \times 1.6 \times 10^{-19} \text{ } \checkmark / 99 \times 1.66 \times 10^{-27} \text{ } \checkmark$ specific charge = $4.2 \times 10^7 \text{ } \checkmark \text{ C kg}^{-1} \checkmark$	4	Correct answer no working -1 If include mass of electrons lose 2 and 3 mark

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### June 13 Q1

1	(a)	(i)	protons = 20✓ neutrons = 28✓ electrons = 18✓	3	
1	(a)	(ii)	$2 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-19}$ ✓(C)	1	-ve sign loses mark
1	(a)	(iii)	specific charge = $3.2 \times 10^{-19} / (48 \times 1.67 \times 10^{-27} + 18 \times 9.11 \times 10^{-31})$ ✓ specific charge = $4.0 \times 10^6$ C kg <sup>-1</sup> ✓	2	Allow 1.66 Allow CE from (ii) First mark is for mass if miss out electron mass and do not justify lose first mark

### June 14 Q2

2	a	(i)	Q/boron/B✓	1	
2	a	(ii)	P and R/ R and P✓	1	
2	a	(iii)	R✓ 6/14 is smallest fraction/0.43 smallest ratio/ $4.13 \times 10^7$ C/kg✓	2	Cannot get second mark if not awarded first mark
2	a	(iv)	${}^{14}_6\text{R} \rightarrow {}^{14}_7\text{X} + {}^0_{-1}\text{e} + \overline{\nu}_{(e)}$ ✓✓✓	3	one mark for each correct symbol on rhs ignore -ve sign on e. Can have neutrino with 0,0 on answer lines ignore any subscript on neutrino
2	b	(i)	<u>repulsive</u> below/at 0.5 fm (accept any value less or equal to 1 fm)✓ <u>attractive</u> up to/at 3 fm (accept any value between 0.5 and 10 fm)✓ short range OR becomes zero OR no effect✓	3	Can get marks from labelled graph Don't accept negligible for 3 <sup>rd</sup> mark
2	b	(ii)	interaction: electromagnetic/em✓ (virtual) photon/ $\gamma$ ✓	2	

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### June 15 Q1

1a		$^{223}_{88}\text{Ra}$	$^{224}_{88}\text{Ra}$	$^{225}_{88}\text{Ra}$	$^{226}_{88}\text{Ra}$	one mark for each correct row (ignore first row as already ticked) allow cross instead of tick and ignore any crossed out ticks if more than one tick in a row then no mark	4	
	Isotope with smallest mass number	(✓)						
	Isotope with most neutrons in nucleus				✓			
	Isotope with nucleus that has highest specific charge	✓						
	Isotope that decays by $\beta^-$ decay to form $^{225}_{89}\text{Ac}$			✓				
	Isotope that decays by alpha decay to form $^{220}_{86}\text{Rn}$		✓					
1bi	the atom has lost <u>two</u> electrons✓						1	
1bii	<i>(use of specific charge = charge ÷ mass)</i> $\text{mass} = 3.2 \times 10^{-10} \div 8.57 \times 10^5 = 3.734 \times 10^{-25} \text{ (kg)}$ $\text{mass number} = 3.734 \times 10^{-25} \div 1.66 \times 10^{-27} \checkmark (= 225)$ hence $^{225}_{(88)}\text{Ra}$ OR 225✓✓ OR calculate specific charge for each isotope✓ hence $^{225}_{(88)}\text{Ra}$ OR 225✓✓					ignore any reference to electrons first mark for deduction bald correct answer scores 2 marks don't need radium symbol or 88  wrong answer scores zero	3	

### June 16 Q1

Question	Answers	Additional Comments/Guidance	Mark	ID details
1(a)	(isotopes have) same number of protons✓  different numbers of neutrons✓	allow atomic mass /proton number  allow mass number /nucleon number  TO where mix up atomic number and mass number	2	
1(b)	$92 \times 1.60 \times 10^{-19} \checkmark$ $(+)1.47 \times 10^{-17} \text{ (C)} \checkmark$ correct power penalise minus sign on answer line	Allow 2 sf answer $1.5 \times 10^{-17} \text{ (C)}$ Pay attention to powers on answer line	2	
1(c)	$(4.8 \times 10^{-19} \div 1.60 \times 10^{-19}) = 3 \checkmark$ $(92 - 3) = 89 \checkmark$ 95 on answer line 1 mark	or $1.47 \times 10^{-17} - 4.8 \times 10^{-19} (= Q) \text{ (ecf)}$ $(n = \frac{Q}{e} = \frac{1.47 \times 10^{-17} - 4.8 \times 10^{-19}}{1.6 \times 10^{-19}}) = 89 \text{ (ecf)}$ Integer value for n	2	
1(d)	$^{237}_{92}\text{U} \rightarrow ^{237}_{93}\text{Np} + ^0_{-1}\beta + \bar{\nu}_{(e)} \checkmark \checkmark \checkmark$	one mark for: <ul style="list-style-type: none"> <li>both numbers correct on Np</li> <li>both numbers correct on <math>\beta^-</math></li> <li>correct symbol for (electron) antineutrino</li> </ul>	3	