01. 0625_m23_ms_42 Q: 9

Question	Answer	Marks
(a)(i)	large unstable nucleus **OR** neutrons hit nucleus **OR** neutrons are released (from nucleus)	**B1**
	(large) nucleus splits (into smaller nuclei)	**B1**
	(large) release of energy	**B1**

Question	Answer	Marks
(a)(ii)	advantage – **one** from: • Continuous supply of energy • not affected by the weather **OR** not affected by wind strength • produces large amounts of energy	**B1**
	disadvantage – **one** from: • resources finite / not renewable • cost / difficulty of building / cost / difficulty of decommissioning • danger if any leak of radiation • produces hazardous / dangerous waste **OR** difficulty of storage of used radioactive material **OR** nuclear waste must be stored for a long time	**B1**
(b)	${}^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{3}_{2}He + {}^{1}_{0}n$	
	LHS correct	**B1**
	${}^{3}_{2}He$ on RHS	**B1**
	${}^{1}_{0}n$ on RHS	**B1**

02. 0625_w23_ms_42 Q: 8

Question	Answer	Marks
(a)	(92 is) the proton number / number of protons (in the nucleus) / atomic number	**B1**
	(235 is) the nucleon number / number of nucleons (in the nucleus) / mass number	**B1**
(b)(i)	(nuclear) fission	**B1**
(b)(ii)	nucleus converted to (more stable) nuclei with smaller total mass	**B1**
	mass (difference) is released / converted as (kinetic) energy (of products) / thermal energy	**B1**
(c)(i)	any **three** from: • (thermal energy) used to heat / boil (cold) water OR make steam • steam is at high pressure • steam drives a turbine • turbine (connected to and) drives a generator • turbine moves a coil in a magnetic field	**B3**
(c)(ii)	advantage - any **one from:** • (much) small(er) amount of fuel needed (to produce same amount of energy) • no greenhouse gases produced OR low carbon dioxide emissions • no air pollution (when operating normally)	**B1**
	disadvantage – any **one** from • danger if any leak of radiation • produces hazardous / dangerous / toxic waste **OR** difficulty of storage of used radioactive material **OR** nuclear waste must be stored for a long time • expensive to build or decommission nuclear power plant or store nuclear waste	**B1**

03. 0625_s22_ms_41 Q: 10

Question	Answer	Marks
(a)(i)	same number of protons / both have one proton	**B1**
(a)(ii)	it / hydrogen-3 / ${}^{3}_{(1)}H$ has one more neutron	**A2**
	different number of neutrons / nucleons	C1

Question	Answer	Marks
(b)(i)	(high temperature produces) high (kinetic) energy / momentum / speed / ability to do large quantity of work	B1
	they repel each other	B1
	are positively charged / have like charges **or** need to come close together	B1
(b)(ii)	${}^{4}_{2}X$ **or** ${}^{4}_{2}He$ **or** ${}^{4}_{2}\alpha$	B1
	${}^{1}_{0}n$ **and** no other particle	B1

04. 0625_s22_ms_42 Q: 11

Question	Answer	Marks
(a)(i)	top: travels to left	B1
	middle: deflected down AND still travels to right	B1
	bottom: straight on	B1

Question	Answer	Marks
(a)(ii)	plus OR positive OR +	B1
(b)	79 (electrons)	B1
	119 (neutrons)	B1
	79 (protons)	B1

05. 0625_s21_ms_41 Q: 9

	Answer	Mark
(a)	${}^{2}_{1}H$ **and** ${}^{3}_{1}H$ **and** in this order	B1
(b)(i)	joining together of (small / H) nuclei	B1
	to produce a bigger nucleus / He nucleus **or** with the release of energy	B1
(b)(ii)	$({}^{2}_{1}H + {}^{3}_{1}H \rightarrow) {}^{1}_{0}n$	B1
	$(+) {}^{4}_{2}(....)$	B1
	He **or** α seen	B1
(c)	any **two** from: • geothermal (energy) • tidal (energy) • nuclear (energy)	B2

06. 0625_w21_ms_42 Q: 11

Question	Answer	Marks
(a)	(very small) nucleus **AND** (surrounded by) electrons (in orbit / shells)	**B1**
	neutrons and protons in nucleus	**B1**
	4 electrons (in atom) OR number of electrons = number of protons	**B1**
	4 neutrons (in nucleus)	**B1**
(b)	$^{135}_{55}$ on left	**B1**
	Cs on left	**B1**
	$^{135}_{56}$Ba on right	**B1**
	+β on right OR –β on left	**B1**

07. 0625_w20_ms_43 Q: 11

Question	Answer	Marks
11(a)	α deflected in smooth curve away from plate P / towards plate Q	**B1**
	α continues in straight line beyond plates OR multiple paths for β and no more than a single α path	**B1**
	β deflected in smooth curve towards plate P / away from plate Q	**B1**
	β deflected more than α	**B1**
	γ passes straight through without deviation **and** continues in straight line beyond plates	**B1**
11(b)	suitable application e.g. sterilisation of equipment, medical diagnosis / treatment, thickness control, detecting leaks / cracks, food preservation	**B1**
	explanation e.g. destroys bacteria, destroys cancer cells, lower amount of radiation detected if thickness too large, radiation detected at site of leak, destroys microbes in food	**B1**

08. 0625_s19_ms_41 Q: 9

(a)(i)	**mark both explanation and deduction together**	
	nucleus is very small	**B1**
	very few α-particles hit or pass near to a nucleus	**B1**
(a)(ii)	**mark both explanation and deduction together**	
	nucleus is charged	**B1**
	(charged) α-particles experience a force	**B1**
(a)(iii)	**mark both explanation and deduction together**	
	centre / (small) part of atom **OR** nucleus includes most of the mass of the atom / is (very) dense	**B1**
	(α-particles move and) nucleus stays still	**B1**
(b)	any **two** from: opposite direction (much) smaller deflection undergo deflections of similar magnitude	**B2**