AQA GCSE Physics

Practice answers

	Answers	Extra information	Mark	AO / Specification reference
01.1	beta and gamma radiation would not be stopped by the smoke but alpha particles are		1 1	AO2 4.4.2.1
01.2	the atomic mass is 241 - 4 = 237 the atomic number is 95 - 2 = 93		1 1 1 1	AO2 4.4.2.2
01.3	the atomic number has changed/the number of protons has changed every element has a different atomic number/no of protons		1 1	AO2 4.4.2.1
02.1	5600		1	AO3
02.2	evidence of using graph to find the time when the activity is 5.0 count/min = 8000 years		1	AO2
02.3	no made from wood from a tree that died about 8000 years ago (so is too young)		1 1	AO3 4.4.2.3
03.1	the activity of a sample is measured in Becquerels (Bq) the activity of a sample is the number of decays recorded per second		1 1	AO1 4.4.2.1
03.2	Geiger counter/Geiger Muller tube/GM tube		1	AO1 4.4.2.1

<table>
<tr><th></th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Specification reference</th></tr>
<tr><td>03.3</td><td>
<table>
<tr><th>Type of radiation</th><th>Is a particle</th><th>Has no charge</th></tr>
<tr><td>alpha</td><td>✓</td><td></td></tr>
<tr><td>beta</td><td>✓</td><td></td></tr>
<tr><td>gamma</td><td></td><td>✓</td></tr>
<tr><td>neutron</td><td>✓</td><td>✓</td></tr>
</table>
</td><td>one mark for each correct column</td><td>2</td><td>AO1
4.4.2.1
4.4.2.2</td></tr>
<tr><td>03.4</td><td>radioactive decay is a random process
as is throwing a die
or
you never know which nucleus will decay next
or know which face on the die will appear next</td><td></td><td>1
1
or
1
1</td><td>AO2
4.4.2.1</td></tr>
<tr><td>04.1</td><td>
<table>
<tr><th>Type</th><th>Range in air</th></tr>
<tr><td>gamma</td><td>> 3 m</td></tr>
<tr><td>beta</td><td>1 m</td></tr>
<tr><td>alpha</td><td>< 10 cm</td></tr>
</table>
</td><td>one mark for one or two correct
two marks for all correct</td><td>2</td><td>AO1
4.4.2.1</td></tr>
</table>

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04.2	no the radiation that is most ionising (is alpha) (which) has the smallest range in air		1 1 1	AO2 4.4.2.1
04.3	the aluminium absorbs alpha and beta radiation (so the activity goes down) gamma is not stopped by the aluminium (so you can still detect the gamma radiation)		1 1	AO2 4.4.2.1
05.1	the number of half-lives = $\frac{90}{30}$ = 3 $\left(\frac{1}{2}\right)^3$ = 0.125 **or** $\frac{1}{8}$ 0.125 x 24 = 3 g		1 1 1	AO2 4.4.2.3
05.2	56 $^{0}_{-1}\beta$ **or** e		1 1	AO2 4.4.2.2
05.3	sheep (eat the grass and) become contaminated the radioactive material inside them decays/emits radiation/could cause cancers		1 1	AO3 4.4.2.2
06.1	the matches/heads of matches are like the (unstable) nuclei the flames are like the neutrons that move between the unstable nuclei when you light one match it sets off the rest of the matches, just like when one neutron is absorbed by an unstable nucleus it can start a chain reaction		1 1 1	AO2 4.4.4.1

	Answers	Extra information	Mark	AO / Specification reference
06.2	the strengths – any **two** from: • when you light one match the rest light • the matches need to be close enough together, just like the nuclei in a bomb/reactor • if the matches are too far apart the reaction stops, just like if there are not enough nuclei the weaknesses – any **two** from: • the nuclei undergo fission, they do not burn • particles (neutrons) are transferred between the nuclei, not flame/energy • the matches continue to burn but nuclei undergo fission once.	one for each correct answer, up to a maximum of two for each of the strengths and weaknesses	4	AO1 4.4.4.1
07.1	food/drink		1	AO1 4.2.2
07.2	space/the Sun		1	AO1 4.2.2
07.3	any sensible suggestion e.g., more medical x-rays/air travel/depends where you live		1	AO2 4.2.2
07.4	(% from radon gas = 48%) dose = 0.48 × 2.7 = 1.3 (1.296) mSv		 1 1	AO2

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07.5	a bar chart/pie chart the data are categoric/not continuous		1 1	AO2
08.1	beta		1	AO2 4.4.2.2
08.2	beta particle high speed/fast moving electron	no marks for charge of -1/no mass	1 1	AO2 4.4.2.2
08.3	neutron converted into proton neutrons and protons have the same mass		1 1	AO2 4.4.2.1 4.4.2.2
08.4	83 protons before X emitted, 84 after (as a neutron changes to a proton) the neutron has no charge, and a proton has a charge of +1 (so the charge increases by 1)		1 1	AO2 4.4.2.2
09	**Level 3:** Correct choice, with clear reasons to do with half-life/radiation transmission through tissue. Clear consequences with discussion of contamination /ionisation and their effects		5-6	AO3 4.4.3.2 4.4.3.3
	Level 2: Correct choice with reason based on half-life. Some discussion of problems with longer half-life isotopes.		3-4	
	Level 1: Correct choice with little or no reasoning.		1-2	
	No relevant comment.		0	

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	Indicative content: • for a tracer you need an isotope with a short half-life (6 hours) so that it doesn't emit too much radiation while inside the body and • which emits gamma radiation that can be detected by the camera • gamma radiation can travel through the body, but beta cannot • so technetium-99 is the correct choice • technetium-99 emits the wrong type of radiation to be detected by the camera • technetium-95 and technetium-99 have longer half lives • so the material would continue to cause damage due to contamination for a long time after the injection			
10.1	line of best fit should be curved		1	AO2

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10.2	two points chosen from count rate and time worked out from them, e.g. 60 evidence of use of graph two marks for halving initial count rate and reading time one mark for use of two values one mark for correctly reading times and subtracting, e.g., 90 – 30 ignore any units written		2 1	AO3 4.4.2.3
10.3	no radioactive decay is random, so there will be a scatter of points on the graph		1 1	AO2 4.4.2.3
10.4	they have not put unit labels on the axes of the graph		1	AO2 4.4.2.3
11.1	contamination means the presence of radioactive material inside of n the human body irradiation is the process of exposing the strawberries to radiation		1 1	AO1 4.4.2.4

	Answers	Extra information	Mark	AO / Specification reference
11.2	you are not taking radioactive material into your body (so there is little or no increase in risk due to ionizing radiation)	accept the radiation passes through the strawberry, it does not stay inside it, so you are not ingesting any radioactive material	1	AO3 4.4.2.4
11.3	scientists do experiments and collect data/draw conclusions their results are checked by other scientists in a process called 'peer review' appropriate reason, e.g., • the regulations deal with radioactive material which can be harmful • the hazards of radioactive material to the human body are significant • people could be harmed if the data is not correct		1 1 1	AO2 4.4.2.4
12.1	temperature is proportional to time until the temperature reaches 97 °C energy transferred by the heater is increasing the internal energy by increasing the kinetic energy of the particles when the temperature reaches 98.5 °C the energy transferred by the heater increases the internal energy by increasing the potential energy of the particles the temperature is constant but the liquid evaporates		1 1 1 1	AO3 4.1.1.3
12.2	energy is proportional to change in temperature while the liquid is heating above 100 °C the increase in energy produces no further change in temperature		1 1	AO3 4.1.1.3

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12.3	*change in thermal energy = mass × specific heat capacity × temperature change* 100 g = 0.1 kg 20 000 = 0.1 x *specific heat capacity* x 60 specific heat capacity = $\frac{20000}{0.1} \times 60$ = 3333.3 J/kg °C = 3300 J/kg °C to two significant figures		1 1 1 1	AO1 AO2 4.1.1.3
12.4	largest possible range reduces percentage error	accept average the error over larger value	1	AO3 4.1.1.3
13.1	resistor		1	AO1 4.2.2
13.2	in circuit one, the voltmeter reads 3 V in circuit two, the voltmeter reads 6 V in circuit one, the potential difference is split between the components/resistors in circuit two, the voltmeter is connected directly across the battery		1 1 1 1	AO2 4.2.2
13.3	there would be no change to the readings the potential difference would still be split in half if the bulbs are identical in circuit one the potential difference is still connected across the battery in circuit one		1 1	AO3 4.2.2
14.1	solar energy is renewable because it will not run out		1 1	AO1 4.1.3

	Answers	Extra information	Mark	AO / Specification reference
14.2	the system of transformers and cables linking power stations to consumers		1	AO1 4.2.4.3
14.3	09:35 to 17:15		1	AO2 4.2.4.3
14.4	the houses use electricity generated by the National Grid		1	AO1 4.2.4.3
14.5	the photovoltaic cells cost money to buy and install you might not like how they look/large number needed to produce sufficient energy		1 1	AO3 4.1.3