UNIT 6: RADIOACTIVITY AND NUCLEAR CHEMISTRY

WASHINGTON LATIN PUBLIC CHARTER SCHOOL

CHEMISTRY 2019-20

UNIT 6 TEST – RADIOACTIVITY AND NUCLEAR REACTIONS

Answer all questions

Recommended time = 25 minutes

You will need a Periodic Table and a calculator

Name:	
Score (open response)	/15
Score (multiple choice)	/5
Bonus (Submits quiz on time and in correct format)	/20
Total:	/40

UNIT 6: RADIOACTIVITY AND NUCLEAR CHEMISTRY

SECTION A - OPEN RESPONSE

Fill in all green cells

1.	Radon is a monatomic gas released naturally by most rocks. All of its isotopes are radioactive; its most abundant isotope, radon-222, is an alpha emitter.	
(a)	Deduce the number of protons and the number of neutrons in an atom of radon-222	2
	Number of protons: use the Periodic Table – it's radon Number of neutrons: Number of neutrons = 222 – number of protons	
(b)	Complete the equation below (by changing Z, A and E to the correct numbers/symbols) to show the decay of radon-222.	2
	$^{222}_{86}Rn \rightarrow ^{A}_{Z}E + ^{4}_{2}\alpha$ A = 222 – 4, Z = 86 – 2; look up the symbol with the correct Z value in the Periodic Table	
(c)	Radon-222 has a half-life of 3.8 days. Calculate the time it would take for the activity of radon-222 to fall to 6.25% of its initial intensity. Show your working.	2
	How many half-lives is 6.25% (look at the table in the study guide) Time taken = 3.8 days x number of half-lives	
(d)	Suggest why it is important to monitor the rate at which different rocks emit radon gas.	2
	Radon is a gas – so what can it do? Why is this a problem if it emits alpha particles?	
TOTAL		8

2.	The sun's energy comes from the following reaction: $^{2}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He + ^{1}_{0}n$ Nuclear energy on earth is generated by the fission of large atoms such as thorium-232.	

UNIT 6: RADIOACTIVITY AND NUCLEAR CHEMISTRY

(a)	What type of reaction is $^2_1H + {}^3_1H \rightarrow {}^4_2He + {}^1_0n$? Explain your answer.		
	Are you joining atoms together or splitting them up? So is it fission or fusion?		2
(b)	State how the fission of thorium-232 is likely to be started.		
	Look it up – what do you have to do to a big atom before it will split?		1
(c)	The fission of thorium-232 produces xenon-137, two neutrons and one other product. Complete the nuclear equation for this fission reaction by replacing Z, A and E with the correct values/symbols.		
	$^{232}_{90}Th \rightarrow {}^{137}_{54}Xe + {}^A_ZE + 2{}^1_0n$ $A = 232 - 137 - 4 - 2$ $Z = 90 - 54$ (find Z, then use the Periodic Table to find the symbol)		2
(d)	Explain why this reaction needs to be controlled, and explain how it is controlled.		
	This reaction produces two neutrons. Why is this a problem? How do we stop this reaction from getting out of control?		2
TOTAL			7

UNIT 6: RADIOACTIVITY AND NUCLEAR CHEMISTRY

SECTION B - MULTIPLE CHOICE

Do not answer these questions on this sheet

Make a note of your answers and enter them in the answer sheet.

3.	Which of the following statements about alpha radiation is true? Alpha particles have very low penetrating power and are only dangerous if you inject, ingest or inhale them. When emitted, they cause the atomic number to decrease by 2.	
	A	It can penetrate skin.
	B	It can travel a long distance through air.
	C	It is very dangerous if inhaled.
	D	When emitted, the atomic number of the nucleus remaining increases by 1
		1

4.	Which atom would phosphorus-32 turn into if it emitted a beta particle? The mass number stays the same The atomic number increases by 1	
	A	Sulfur-33
	B	Sulfur-32
	C	Silicon-32
	D	Silicon-31
		1

5.	Briana has 1000 atoms of plutonium-239, which has a half-life of 24,000 years. How many plutonium-239 atoms will Briana have left after 48,000 years? 48000 years = 2 half-lives Look at the table – what % will remain after two half-lives?	
	A	750
	B	500
	C	250
	D	125
		1

UNIT 6: RADIOACTIVITY AND NUCLEAR CHEMISTRY

6.	Which of the following statements is not true?
	The main advantage of fusion over fission is that it does not produce radioactive waste
	The main advantage of fission over fusion is that it can be started easily and then controlled
A	Joining together hydrogen atoms to make helium atoms releases a lot of energy
B	There are no nuclear fusion power stations on earth.
C	Very high temperatures are needed to achieve nuclear fusion.
D	Nuclear fusion reactions usually produce harmful radioactive waste.
	1

7.	The fusion of helium-3 with nitrogen-14 would produce oxygen-16 and
	Helium-3 = ^3_2He, nitrogen-14 = $^{14}_7\text{N}$; add these up – what is the total A and what is the total Z?
	Now subtract $^{16}_8\text{O}$ – what is left?
A	A proton ^1_1H
B	A neutron ^1_0n
C	An alpha particle ^4_2He
D	A beta particle $^0_{-1}\text{e}$
	1

End of Test

Answer sheet and exit ticket