8.2 Types of oxides

01. 0620_s17_qp_41 Q: 2

Some oxides of some elements are listed.

CO	CO_2	Na_2O	MgO	Al_2O_3
SiO_2	P_4O_{10}	SO_2	Cl_2O_7	Cr_2O_3

(a) Answer the following questions using only oxides from the list. Each oxide may be used once, more than once or not at all.

Give the formula of an oxide

(i) which is the main cause of acid rain, ...

(ii) which would give a solution of pH 14 when added to water, ...

(iii) which is coloured, ...

(iv) which is the major impurity in iron ore, ...

(v) which is amphoteric, ...

(vi) which is neutral. .....

[6]

(b) Amphoteric oxides and neutral oxides are different from each other.

(i) What is meant by the term *amphoteric oxide*?

.....

..... [1]

(ii) What is meant by the term *neutral oxide*?

.....

..... [1]

[Total: 8]

02. 0620_w13_qp_33 Q: 1

Zirconium (Zr) is a metal in Period 5. Its main oxidation state is +4.

(a) The following are all zirconium atoms: $^{90}_{40}Zr$, $^{91}_{40}Zr$ and $^{92}_{40}Zr$.

In terms of numbers of electrons, neutrons and protons, how are these three atoms the same and how are they different?

They are the same because .....

.....

They are different because .....

..... [3]

(b) Containers for fuel rods in nuclear reactors are made of zirconium.
Nuclear reactors are used to produce energy and to make radioactive isotopes.

(i) Which isotope of a different element is used as a fuel in nuclear reactors?

..... [1]

(ii) State one medical and one industrial use of radioactive isotopes.

.....

..... [2]

(iii) Above 900 °C, zirconium reacts with water to form zirconium(IV) oxide, ZrO_2, and hydrogen. Write an equation for this reaction.

..... [2]

(iv) In a nuclear accident, water may come in contact with very hot zirconium.
Explain why the presence of hydrogen inside the reactor greatly increases the danger of the accident.

..... [1]

(c) It is possible to determine whether zirconium(IV) oxide is acidic, neutral, basic or amphoteric using an acid and an alkali. Complete the table of possible results. If the oxide is predicted to react write 'R', if it is predicted not to react write 'NR'.

if the oxide is	predicted result with hydrochloric acid	predicted result with aqueous sodium hydroxide
acidic		
neutral		
basic		
amphoteric		

[4]

[Total: 13]

03. 0620_w12_qp_31 Q: 4

Silicon(IV) oxide, SiO_2, and zirconium(IV) oxide, ZrO_2, are both macromolecules.
They have similar physical properties but silicon(IV) oxide is acidic and zirconium(IV) oxide is amphoteric.

(a) Define the term *macromolecule*.

.....

..... [1]

(b) (i) Predict **three** physical properties of these two oxides.

.....

.....

..... [3]

(ii) Name an element which has the same physical properties as these two oxides.

..... [1]

(c) (i) Name a reagent that reacts with the oxides of both elements.

..... [1]

(ii) Name a reagent that reacts with only one of the oxides.

reagent .....

oxide which reacts ..... [2]

[Total: 8]

01. 0620_s17_ms_41 Q: 2

(a)(i)	SO_2	1
(a)(ii)	Na_2O	1
(a)(iii)	Cr_2O_3	1
(a)(iv)	SiO_2	1
(a)(v)	Al_2O_3 / Cr_2O_3	1
(a)(vi)	CO	1
(b)(i)	an amphoteric oxide will react with acids **AND** with bases	1
(b)(ii)	a neutral oxide will **not** react with acids **or** with bases	1

02. 0620_w13_ms_33 Q: 1

(a) same number of protons [1]
same number of electrons [1]
different number of neutrons [1]

(b) (i) ^{235}U / ^{239}Pu [1]
NOTE: need symbol or name and nucleon number

(ii) treating cancer / chemotherapy / radiographs / tracer studies / x–ray (scans) / sterilise surgical instruments / diagnose or treat thyroid disorders / radiotherapy [1]

paper thickness / steel thickness / radiographs / welds / tracing / fill levels in packages / food irradiation / smoke detectors [1]
ACCEPT: any other uses

(iii) $Zr + 2H_2O \rightarrow ZrO_2 + 2H_2$ [2]
not balanced = (1) only

(iv) hydrogen explodes / fire (risk) [1]

(c)

if the oxide is	predicted result with hydrochloric acid	predicted result with aqueous aqueous sodium hydroxide
acidic	NR	R
neutral	NR	NR
basic	R	NR
amphoteric	R	R

(1) per line [4]

[Total: 13]

03. 0620_w12_ms_31 Q: 4

(a) giant covalent; [1]
or: polymer made from monomers;

(b) **(i)** any three from:
high mp / bp;
hard;
brittle;
insoluble (in water);
poor conductor of electricity / heat; [3]

(ii) carbon / diamond / silicon / boron; [1]
not: graphite

(c) **(i)** sodium hydroxide / any named alkali / reactive metal; [1]

(ii) named acid; [1]
zirconium oxide; [1]

[Total: 8]