

Assessment

How introduced species affect ecosystems

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1. E 2. A 3. G 4. D 5. B 6. F 7. C 8. A 9. A 10. D 11. B
12. C

UNIT 2 Chemical Reactions and Radioactivity

Chapter 4 Atomic theory explains the formation of compounds.

Section 4.1 Atomic Theory and Bonding

Comprehension

The atom and the subatomic particles

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- (a) atomic number
(b) symbol
(c) name
(d) average atomic mass
(e) common ion charge
(f) other ion charge
- (a) 35
(b) 79.9
(c) 1-
(d) 35
(e) bromine
(f) 45

3.

Element Name	Atomic Number	Ion Charge	Number of Protons	Number of Electrons	Number of Neutrons
potassium	19	1+	19	18	20
phosphorus	15	0	15	15	16
lithium	3	0	3	3	4
calcium	20	2+	20	18	20
nitrogen	7	3-	7	10	7
boron	5	0	5	5	6
argon	18	0	18	18	22
aluminum	13	3+	13	10	14
chlorine	17	0	17	17	19
sodium	11	1+	11	10	12

Applying Knowledge

Bohr diagrams

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- (a) a diagram that shows how many electrons are in each shell surrounding the nucleus

(b) an arrangement of eight electrons in the outermost shell

(c) outermost shell that contains electrons

(d) electrons in the outermost shell

2.

Atom/ion	Atomic Number	Number of Protons	Number of Electrons	Number of Neutrons	Number of Electron Shells
neon atom	10	20	10	10	2
fluorine atom	9	9	9	10	2
fluorine ion	9	9	10	10	2
sodium atom	11	11	11	12	3
sodium ion	11	11	10	12	2

3.

neon atom	fluorine atom	fluorine ion	sodium atom	sodium ion

4.

carbon dioxide (CO ₂)	ammonia (NH ₃)	calcium chloride (CaCl ₂)

Illustrating Concepts

Lewis diagrams

Page 62

- (a) a diagram that illustrates chemical bonding by showing only an atom's valence electrons and the chemical symbol
(b) pair of electrons in the valence shell that is not used in bonding
(c) pair of electrons involved in a covalent bond
- (a) $\cdot \text{B} \cdot$
(b) $\cdot \ddot{\text{N}} \cdot$
(c) $\cdot \text{Al} \cdot$
(d) $:\ddot{\text{Cl}}:$
- (a) $[\text{Na}]^+ [\ddot{\text{O}}:]^{2-} [\text{Na}]^+$
(b) $[\text{K}]^+ [\ddot{\text{Cl}}:]^-$

Section 3.3 How Introduced Species Affect Ecosystems

Comprehension Introduced species Page 52

1. Native species are plants and animals that naturally inhabit an area.
2. An invasive species are organisms that can take over the habitat of native species or invade their bodies.
3. Invasive species often have high reproduction rates, are aggressive competitors, and lack natural predators in their new habitat. Exploiting the new niche, an invasive species can dramatically change an ecosystem.
4. An introduced species can affect a native species through competition, predation, disease, parasitism, and habitat alteration.
5. Examples could include Eurasian milfoil, purple loosestrife, Norway rat, American bullfrog, European starling, Scotch broom, English ivy, and invasive grasses.
6. Scotch broom, English ivy, and invasive grasses are competing with Garry oak trees.
7. Scotch broom produces up to 18 000 seeds per plant. Its yellow flower attracts bees for pollination and it is well adapted for drought.

Applying Knowledge

The impact of introduced invasive species Page 53

Answers could vary depending on the ecosystem.
Answers given are referenced from textbook pages 140–141.

METHOD	INVASIVE SPECIES	EFFECT ON ECOSYSTEM
competition	carpet burweed	<ul style="list-style-type: none"> • burweed competes with four native plants • spiny tips pierce skin of animals and humans
predation	yellow crazy ants	<ul style="list-style-type: none"> • ants build supercolonies • devour all plants and prey on young of reptiles, birds, and mammals • ants killed 20 million land crabs on Christmas Island

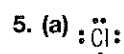
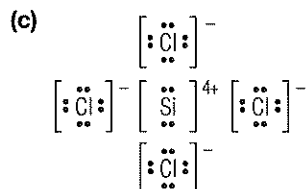
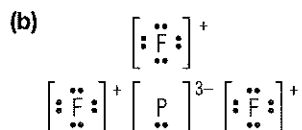
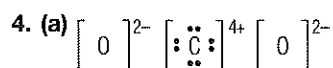
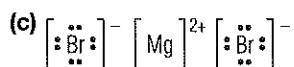
METHOD	INVASIVE SPECIES	EFFECT ON ECOSYSTEM
disease and/or parasites	parasitic lampreys blister rust	<ul style="list-style-type: none"> • lampreys use sucker-like mouths to attach to fish, then suck the body fluids from prey • blister rust fungus weakens whitebark pine tree defenses making it more vulnerable to insect infestations
habitat alteration	wild boars	<ul style="list-style-type: none"> • damage environment by rooting and wallowing • spread weeds that interfere with natural succession • eat native birds, reptiles, frogs, soil organisms, fruit, seeds, and bulbs • boars are considered world's most invasive species

Extension Activity

Invasive species in British Columbia Page 54

Answers may include:

SPECIES	METHOD OF INTRODUCTION	EFFECT ON ENVIRONMENT
purple loosestrife	seeds from Europe in 1800s	<ul style="list-style-type: none"> • destroys wetlands and chokes out other plants • too dense to effectively shelter wildlife
Eurasian milfoil	brought to North America in 1800s	<ul style="list-style-type: none"> • cuts off sunlight to organisms below • interferes with recreational activities
Norway rat	escaped from early European explorer and fur-trading ships	<ul style="list-style-type: none"> • feeds on any food source • eats eggs and young of ground-nesting sea birds, causing their decline
American bullfrog	brought to British Columbia in 1930s for frogs' legs in restaurants	<ul style="list-style-type: none"> • takes over habitats • eats native frogs • attacks ducks and small mammals
European starling	late 1800s, fifty pairs brought to North America	<ul style="list-style-type: none"> • outcompetes native birds for nesting sites • devastates fruit and grain crops
Scotch broom	Mid-1800s, introduced as decorative garden plant	<ul style="list-style-type: none"> • replaces native scrubs • ruins habitat for native birds and butterflies • creates an overload of nitrogen that interferes with growth of some native species



Assessment

Atomic theory and bonding

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1. C 2. A 3. B 4. E 5. D 6. B 7. D 8. D 9. D 10. A 11. B
12. B 13. A 14. A 15. C 16. B

Section 4.2 Names and Formulas of Compounds

Comprehension

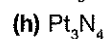
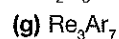
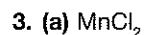
Multivalent metals and polyatomic ions

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1. (a) a compound made up of a metal and a non-metal
(b) a metal that has more than one ion charge
(c) an ion composed of more than one type of atom joined by covalent bonds

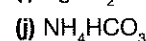
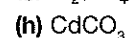
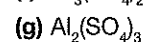
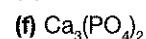
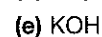
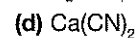
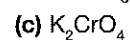
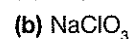
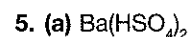
2.

	Positive ion	Negative ion	Formula	Compound name
(a)	Pb ²⁺	O ²⁻	PbO	lead(II) oxide
(b)	Sb ⁴⁺	S ²⁻	SbS ₂	antimony(IV) sulphide
(c)	Tl ⁺	Cl ⁻	TlCl	thallium(I) chloride
(d)	Sn ²⁺	F ⁻	SnF ₂	tin(II) fluoride
(e)	Mo ³⁺	S ²⁻	Mo ₂ S ₃	molybdenum(III) sulphide
(f)	Rh ⁴⁺	Br ⁻	RhBr ₄	rhodium(IV) bromide
(g)	Cu ⁺	Te ²⁻	Cu ₂ Te	copper(I) telluride
(h)	Nb ⁵⁺	I ⁻	NbI ₅	niobium(V) iodide
(i)	Pd ²⁺	Cl ⁻	PdCl ₂	palladium(II) chloride



4.

	Ions	Formula	Compound name
(a)	K ⁺ NO ₃ ⁻	KNO ₃	potassium nitrate
(b)	Ca ²⁺ CO ₃ ²⁻	CaCO ₃	calcium carbonate
(c)	Li ⁺ HSO ₄ ⁻	LiHSO ₄	lithium bisulphate or lithium hydrogen sulphate
(d)	Mg ²⁺ SO ₃ ²⁻	MgSO ₃	magnesium sulphite
(e)	Sr ²⁺ CH ₃ COO ⁻	Sr(CH ₃ COO) ₂	strontium acetate
(f)	NH ₄ ⁺ Cr ₂ O ₇ ²⁻	(NH ₄) ₂ Cr ₂ O ₇	ammonium dichromate
(g)	Na ⁺ MnO ₄ ⁻	NaMnO ₄	sodium permanganate
(h)	Ag ⁺ ClO ₃ ⁻	AgClO	silver hypochlorite
(i)	Cs ⁺ OH ⁻	CsOH	cesium hydroxide
(j)	Ba ²⁺ CrO ₄ ²⁻	BaCrO ₄	barium chromate



Comprehension

Chemical names and formulas of ionic compounds

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1. (a) beryllium sulphide
(b) mercury(II) nitride
(c) copper(II) nitrate
(d) silver oxide
(e) cobalt(II) bromide
(f) bismuth(V) phosphate
(g) calcium fluoride

- (h) manganese(III) oxide
- (i) chromium(III) sulphate
- (j) zinc chloride
- (k) nickel(II) hydroxide
- (l) potassium dichromate
- (m) scandium fluoride
- (n) sodium iodide
- (o) lead(II) carbonate
- (p) rubidium chlorite
- (q) potassium phosphide
- (r) magnesium cyanide
- (s) tin(II) sulphide
- (t) sodium bicarbonate or sodium hydrogen carbonate

2. (a) AlBr_3
 (b) PtS
 (c) SrSO_3
 (d) Sc_2O_3
 (e) $\text{Ti}(\text{NO}_2)_4$
 (f) $(\text{NH}_4)_2\text{SO}_4$
 (g) Li_2Se
 (h) $\text{Pb}(\text{HSO}_4)_2$
 (i) NaCH_3COO
 (j) CsCl
 (k) $\text{Cd}(\text{OH})_2$
 (l) $\text{Zn}_3(\text{PO}_4)_2$
 (m) BaCl_2
 (n) $\text{Sn}(\text{MnO}_4)_2$
 (o) LiClO
 (p) $\text{Au}_2(\text{SO}_4)_3$
 (q) NaNO_3
 (r) CrCl_3
 (s) K_2CO_3
 (t) $\text{Fe}(\text{HSO}_4)_3$

Comprehension

Chemical names and formulas of covalent compounds

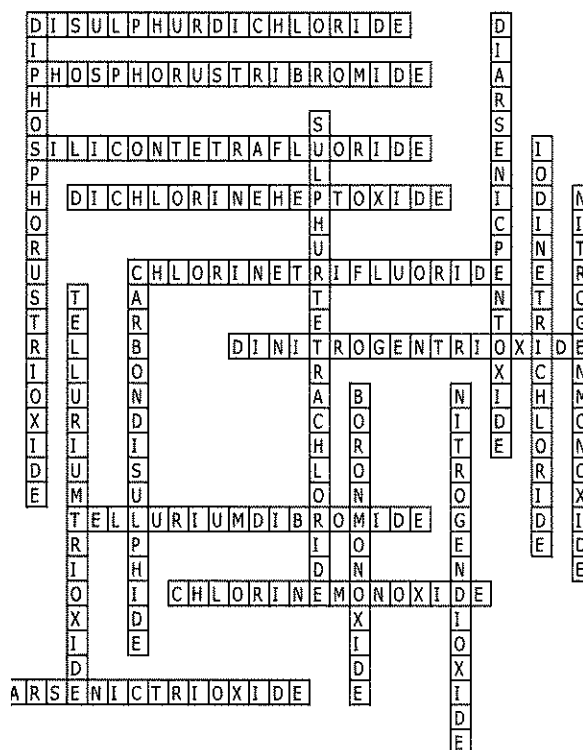
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- a compound consisting of two non-metals; a compound that involves the sharing of electrons
- covalent bond
- prefixes: mono, di, tri, tetra, penta, hexa, hepta, octa, nona, deca
- (a) SiO_2
 (b) ClO_2
 (c) TeO_2
 (d) SeO_3

- (e) CS_2
- (f) AsCl_3
- (g) ClO_7
- (h) SeF_2
- (i) N_2O_5
- (j) N_2O
- (k) AsBr_4
- (l) AsCl_5
- (m) S_2O_5
- (n) SCl
- (o) PCl_3
- (p) P_2O_5

5.

COVALENT COMPOUNDS



Word List

Arsoenic trioxide
 Boron monoxide
 Carbon disulphide
 Chlorine monoxide
 Diarsenic pentoxide
 Dichlorine heptoxide
 Dinitrogen trioxide
 Disulphur dichloride
 Iodine trichloride
 Nitrogen dioxide
 Nitrogen monoxide
 Phosphorus tribromide
 Silicon tetrafluoride
 Sulphur tetrachloride
 Tellurium dibromide
 Tellurium trioxide

ACROSS

- S_2Cl_2
- PBr_3
- SiF_4
- Cl_2O_7
- ClF_3
- N_2O_3
- TeBr_2
- ClO
- AsO_3

DOWN

- P_2O_3
- As_2O_5
- SnCl_4
- ICl_3
- NO
- CS_2
- TeO_3
- BO
- NO_2

Assessment

Names and formulas of compounds

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1. F 2. C 3. I 4. B 5. C 6. D 7. A 8. C 9. D 10. D 11. C
12. B

Section 4.3 Chemical Equations

Comprehension

Balancing equations

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- $H_2 + F_2 \rightarrow 2 HF$
- $2 Sn + O_2 \rightarrow 2 SnO$
- $MgCl_2 \rightarrow Mg + Cl_2$
- $2 KNO_3 \rightarrow 2 KNO_2 + O_2$
- $2 BN + 3 F_2 \rightarrow 2 BF_3 + N_2$
- $CuI_2 + Fe \rightarrow FeI_2 + Cu$
- $2 Li + 2 H_2O \rightarrow 2 LiOH + H_2$
- $4 NH_3 + 3 O_2 \rightarrow 2 N_2 + 6 H_2O$
- $V_2O_5 + 5 Ca \rightarrow 5 CaO + 2 V$
- $2 C_9H_6O_4 + 17 O_2 \rightarrow 18 CO_2 + 6 H_2O$
- $H_2S + PbCl_2 \rightarrow PbS + 2 HCl$
- $2 C_3H_7OH + 9 O_2 \rightarrow 6 CO_2 + 8 H_2O$
- $Zn + CuSO_4 \rightarrow Cu + ZnSO_4$
- $C_6H_{12}O_6 + 6 O_2 \rightarrow 6 CO_2 + 6 H_2O$
- $C_2H_5OH + 3 O_2 \rightarrow 2 CO_2 + 3 H_2O$
- $2 Al + 3 H_2SO_4 \rightarrow 3 H_2 + Al_2(SO_4)_3$
- $2 FeCl_3 + 3 Ca(OH)_2 \rightarrow 2 Fe(OH)_3 + 3 CaCl_2$
- $Pb(NO_3)_2 + K_2CrO_4 \rightarrow PbCrO_4 + 2 KNO_3$
- $Cd(NO_3)_2 + (NH_4)_2S \rightarrow CdS + 2 NH_4NO_3$
- $Ca(OH)_2 + 2 NH_4Cl \rightarrow 2 NH_3 + CaCl_2 + 2 H_2O$

Applying Knowledge

Word equations

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- $2 H_2 + O_2 \rightarrow 2 H_2O$
- $Fe_2O_3 + 3 H_2 \rightarrow 3 H_2O + 2 Fe$
- $2 Na + 2 H_2O \rightarrow 2 NaOH + H_2$
- $Ca_2C + O_2 \rightarrow 2 Ca + CO_2$
- $2 KI + Cl_2 \rightarrow 2 KCl + I_2$
- $4 Cr + 3 SnCl_4 \rightarrow 4 CrCl_3 + 3 Sn$
- $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$
- $ZnSO_4 + SrCl_2 \rightarrow ZnCl_2 + SrSO_4$
- $3 NH_4Cl + Pb(NO_3)_3 \rightarrow 3 NH_4NO_3 + PbCl_3$
- $2 Fe(NO_3)_3 + 3 MgS \rightarrow Fe_2S_3 + 3 Mg(NO_3)_2$
- $2 AlCl_3 + 3 Na_2CO_3 \rightarrow Al_2(CO_3)_3 + 6 NaCl$
- $2 Na_3PO_4 + 3 Ca(OH)_2 \rightarrow 6 NaOH + Ca_3(PO_4)_2$

Extension

Chemical reactions and chemical equations

Page 79

- iron + oxygen \rightarrow iron(II) oxide
 $2Fe + O_2 \rightarrow 2 FeO$
- hydrogen chloride + sodium carbonate \rightarrow carbon dioxide + sodium chloride + water
 $2 HCl + Na_2CO_3 \rightarrow CO_2 + 2 NaCl + H_2O$
- aluminum + oxygen \rightarrow aluminum oxide
 $4 Al + 3 O_2 \rightarrow 2 Al_2O_3$
- water + sodium oxide \rightarrow sodium hydroxide
 $H_2O + Na_2O \rightarrow 2 NaOH$
- hydrogen + nitrogen trifluoride \rightarrow
nitrogen + hydrogen fluoride
 $3 H_2 + 2 NF_3 \rightarrow N_2 + 6 HF$
- chromium(III) sulphate + potassium carbonate \rightarrow
chromium(III) carbonate + potassium sulphate
 $Cr_2(SO_4)_3 + 3 K_2CO_3 \rightarrow Cr_2(CO_3)_3 + 3 K_2SO_4$
- potassium chlorate \rightarrow oxygen + potassium chloride
 $2 KClO_3 \rightarrow 3 O_2 + 2 KCl$
- zinc + copper(II) sulphate \rightarrow copper + zinc sulphate
 $Zn + CuSO_4 \rightarrow Cu + ZnSO_4$

Assessment

Chemical equations

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1. B 2. A 3. E 4. D 5. F 6. C 7. G 8. D 9. D 10. D 11. A
12. C 13. B

Chapter 5 Compounds are classified in different ways.

Section 5.1 Acids and Bases

Applying Knowledge

pH scale and pH indicators

Page 84

- (a) chemical that changes colour depending on the pH of the solution it is placed in
(b) number scale for measuring how acidic or basic a solution is
- (a)

Substance	pH Value	Acid or Base	Methyl Orange	Bromothymol Blue	Litmus
lemon	2	acid	red	yellow	red
ammonia	11	base	yellow	blue	blue
milk	6	acid	yellow	yellow	red

(b)

Substance	pH Value	Acid or Base	Methyl Red	Phenolphthalein	Indigo Carmine
tomato	4	acid	red	colourless	blue
oven cleaner	13	base	yellow	pink	yellow
egg	8	base	yellow	colourless	blue

3.

Substance	pH Value	Acid or Base	pH Indicator	Colour of pH Indicator
black coffee	5	acid	litmus	red
milk of magnesia	10	base	phenolphthalein	pink
battery acid	0	acid	bromothymol blue	yellow
sea water	8	base	indigo carmine	blue
orange juice	3	acid	methyl orange	red
liquid drain cleaner	14	base	methyl red	yellow

Comprehension Names of acids Page 86

- ate
- ite
- (a) carbonic acid

(b) acetic acid

(c) phosphoric acid

(d) chlorous acid

(e) sulphurous acid

(f) nitric acid

(g) hydrofluoric acid

(h) hydrochloric acid
- (a) HI

(b) H_2SO_4

(c) $HClO_4$

(d) HNO_2

(e) $HClO_3$

(f) HBr

(g) H_3PO_3

(h) HClO

Applying Knowledge Acids versus bases Page 87

	ACIDS	BASES
definition	compounds containing hydrogen that produce a solution with a pH of less than 7 when they dissolve in water and that produce a salt and water when they react with ionic compounds containing hydroxide ions	chemical compounds containing hydroxide that produce a solution with a pH of more than 7 when they dissolve in water and produce a salt and water when they react with ionic compounds containing positive hydrogen ions
pH	< 7	> 7
what to look for in chemical formula	H	OH
production of ions	H^+	OH^-
electrical conductivity	conductive	conductive
taste	taste sour	taste bitter
touch	burn skin	feel slippery; burn skin
examples	HCl, H_2SO_4 , lemons, stomach acid	NaOH, KOH, drain cleaner, soap

- (a) acid

(b) base

(c) base

(d) acid

(e) base

(f) acid

(g) acid

(h) base

(i) acid

(j) base

(k) base

(l) acid

Assessment Acids and bases Page 88

- D
- F
- A
- E
- B
- G
- C
- A
- A
- C
- A
- C
- B
- B