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BUKIT MERAH SECONDARY SCHOOL



END-OF-YEAR EXAMINATION 2024 SECONDARY 4 EXPRESS

CHEMISTRY

Paper 1 Multiple Choice

6092/01

21 August 2024

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your class, index number and name on all the work you hand in.

There are **forty** questions in this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this question paper.

A copy of the Periodic Table is printed on page 18.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **17** printed pages and **1** blank page.

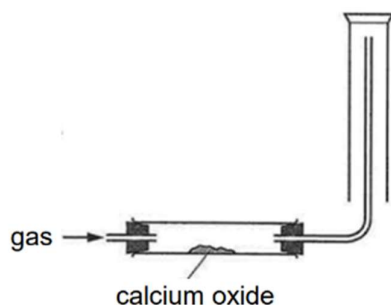
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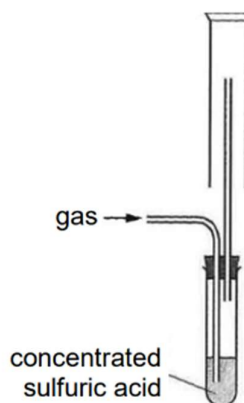
- 1 A gas dissolves readily in water, turns moist blue litmus paper red, and is denser than air.

Which set-up should be used to dry and collect this gas?

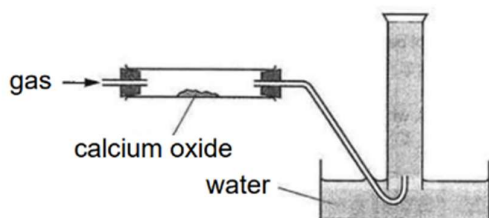
A



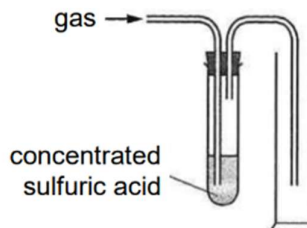
B



C



D



- 2 Hexane and water are immiscible liquids.

Which method could be used to separate a mixture of hexane and water and how is the purity of the separated hexane checked?

	method of separation	purity check
A	filtration	find the boiling point
B	filtration	by sublimation
C	use a separating funnel	find the boiling point
D	use a separating funnel	by sublimation

3 Under the same conditions, which of the following gases would diffuse at the same rate as ethene?

- 1 carbon monoxide
- 2 carbon dioxide
- 3 ethane
- 4 nitrogen

- A 1 and 3 only
- B 1 and 4 only
- C 2 and 3 only
- D 2 and 4 only

4 The boiling points of four substances found in air are given in the table.

Air is cooled to $-190\text{ }^{\circ}\text{C}$ such that some substances condense into liquid.

When the temperature is then raised, which liquid would turn into a gas first?

	substance	boiling point / $^{\circ}\text{C}$
A	argon	-186
B	carbon dioxide	-78 (sublimes)
C	nitrogen	-196
D	oxygen	-183

5 Excess aqueous ammonia is added to a solution containing aluminium ions, copper(II) ions and zinc ions. The mixture is then filtered.

Which ion(s) will be found in the resulting residue?

- A aluminium ions
- B aluminium ions and zinc ions
- C copper(II) ions
- D copper(II) ions and zinc ions

6 Which reagent(s) can be used to distinguish between aqueous zinc nitrate and aqueous calcium chloride?

1. aqueous sodium carbonate
2. aqueous lead(II) nitrate
3. dilute sulfuric acid

- A** 1 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

7 Which set of three particles have the same total number of electrons?

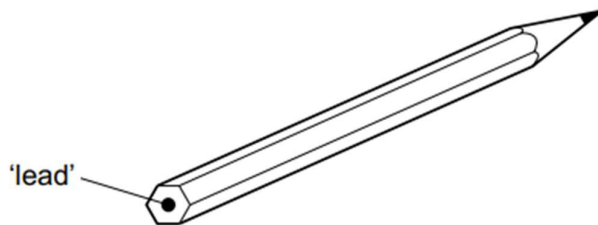
- A** Cl^- Br^- I^-
B F^- Ne Na^+
C K^+ Ca^{2+} Br^-
D Li^+ Na^+ K^+

8 Unknown elements X and Y form an ionic compound X_2Y .

What is the correct electron arrangement of the atoms X and Y?

	atom X	atom Y
A	2, 1	2, 6
B	2, 2	2, 6
C	2, 2	2, 7
D	2, 6	2, 1

- 9 The 'lead' in a pencil is made of a mixture of graphite and clay.



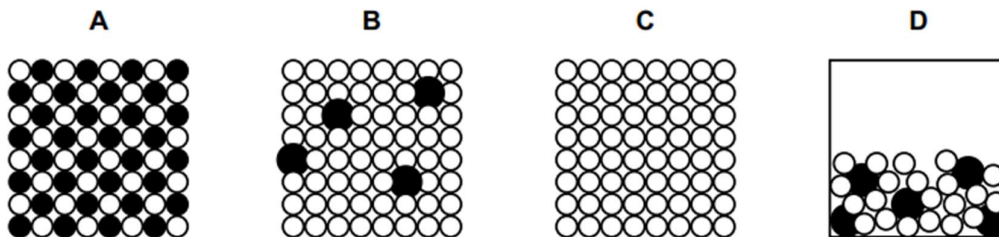
When the percentage of graphite is increased, the pencil moves across the paper more easily.

Which statement explains this observation?

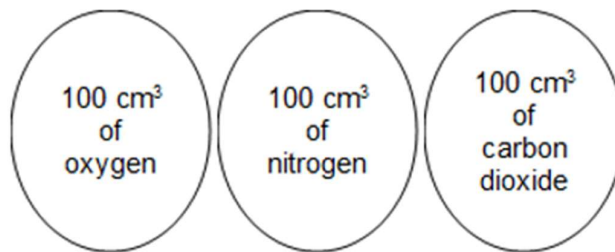
- A Graphite has a high melting point.
 - B Graphite is a form of carbon
 - C Graphite is a lubricant.
 - D Graphite is a non-metal.
- 10 A covalent molecule M contains a total of four shared electrons.

What is M?

- A ammonia, NH_3
 - B hydrogen chloride, HCl
 - C methane, CH_4
 - D water, H_2O
- 11 Which diagram represents a solid alloy?



12 The diagram shows three balloons filled with different gases.



Which statements about the gases in the balloons are correct?

1. The number of moles of gases in the three balloons is different.
2. The number of molecules in the three balloons is the same.
3. The mass of gases in the three balloons is different.

- A** 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

13 Chlorine gas is a severe irritant to the eyes and respiratory system. The maximum safe toleration of chlorine gas in air is 0.005 mg/dm^3 .

How many molecules of chlorine gas are present in 1 dm^3 of air at this toleration level?

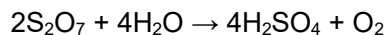
- A** $0.005 \div 1000 \times 1 \div 71 \times (6 \times 10^{23})$
B $0.005 \div 71 \times (6 \times 10^{23})$
C $0.005 \div (6 \times 10^{23}) \times 71$
D $0.005 \div 1000 \times 71 \times (6 \times 10^{23})$

- 14** in an experiment, 12.0 cm³ of propane and 18.0 cm³ of butane are mixed and ignited with a surplus of oxygen, and then allowed to cool to room temperature. The remaining gas is made to flow through an aqueous solution of sodium hydroxide.

What is the volume of gas absorbed by the alkali?

- A** 36.0 cm³
- B** 72.0 cm³
- C** 108 cm³
- D** 216 cm³

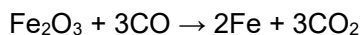
- 15** The compound S₂O₇ reacts with water to produce sulfuric acid and oxygen gas.



What volume of oxygen, measured at room temperature and pressure, is evolved when 0.704 g of S₂O₇ reacts with excess water?

- A** 0.0240 dm³
- B** 0.0480 dm³
- C** 0.0960 dm³
- D** 0.192 dm³

- 16** The equation for the reduction of iron ore in the blast furnace is shown below. When 60 tonnes of the iron ore was reduced, 21 tonnes of molten iron was produced.



What is the percentage yield of this purification process?

- A** 25 %
- B** 50 %
- C** 75 %
- D** 100 %

17 What is the relative molecular mass of propanoic acid?

- A 58
- B 60
- C 74
- D 88

18 Which statement about a dilute solution of a strong acid, HX, is incorrect?

- A The solution contains hydroxide ions.
- B The solution contains a low concentration of HX molecules.
- C The solution contains more water molecules than hydrogen ions.
- D The solution turns blue litmus paper red.

19 Which equation shows the most suitable reaction for making lead(II) sulfate?

- A $\text{Pb} + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{H}_2$
- B $\text{PbCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{CO}_2 + \text{H}_2\text{O}$
- C $\text{Pb}(\text{NO}_3)_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + 2\text{HNO}_3$
- D $\text{PbCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + 2\text{HCl}$

20 Solid P conducts electricity and has a high melting point.

When solid P is warmed with excess dilute hydrochloric acid, it partially dissolves leaving behind a residue.

What is P?

- A brass
- B copper(II) oxide
- C graphite
- D iron

21 Which process is a redox reaction?

- A formation of ammonium sulfate from aqueous ammonia and sulfuric acid.
- B formation of calcium oxide from calcium carbonate
- C formation of silver chloride from aqueous silver nitrate and aqueous sodium chloride
- D formation of sulfuric acid from sulfur dioxide

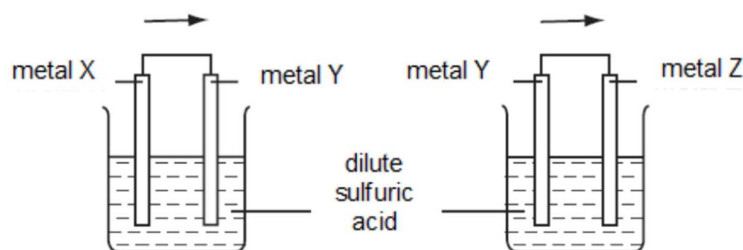
22 Which row shows the waste products released from the exhaust of a vehicle powered using a hydrogen–oxygen fuel cell?

	carbon dioxide	oxides of nitrogen	water
A	✓	✓	✓
B	✗	✓	✓
C	✓	✗	✗
D	✗	✗	✓

23 Which pair of electrolyte and electrodes will not result in a change in the concentration of the solution during electrolysis?

	electrolyte	electrodes
A	copper(II) nitrate	carbon
B	copper(II) nitrate	copper
C	sodium nitrate	carbon
D	sodium nitrate	copper

- 24 Two cells were set up as shown in the diagram. The arrows show the direction of electron flow in the external circuits.



	metal X	metal Y	metal Z
A	copper	silver	zinc
B	silver	copper	zinc
C	silver	zinc	copper
D	zinc	copper	silver

- 25 Period 3 of the Periodic Table is shown.

Na	Mg	Al	Si	P	S	Cl	Ar
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What increases from Na to Ar across Period 3?

- A** density
 - B** melting point
 - C** non-metallic character
 - D** the number of electron shells
- 26 The element with proton number 12 has similar chemical properties to the element with which proton number?
- A** 2
 - B** 11
 - C** 20
 - D** 24

- 27** A coil of clean copper wire is suspended in a beaker of aqueous silver nitrate. Crystals of silver are deposited on the copper wire.

Which statement is not correct?

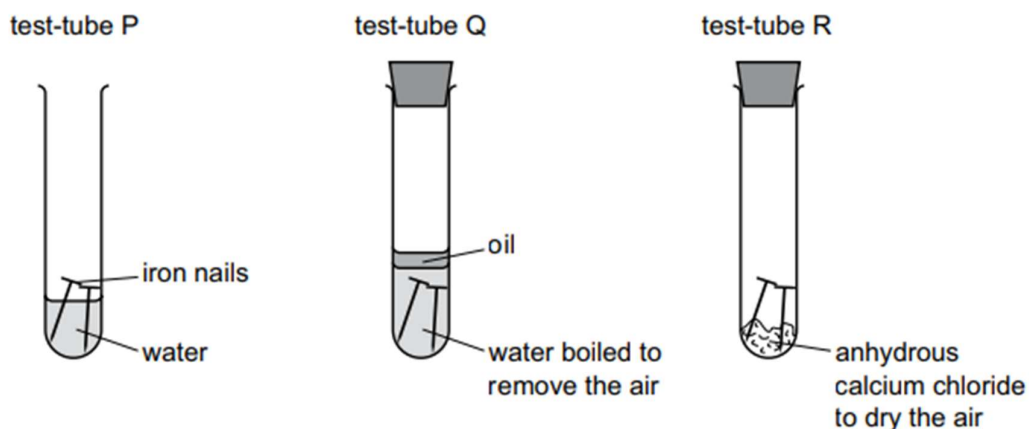
- A** The copper is oxidised.
- B** The solution turns blue.
- C** The total mass of the crystals of silver increases gradually.
- D** The total number of positive ions in the solution is unchanged.
- 28** Metals W, X, Y and Z are reacted with dilute hydrochloric acid. The oxides of metals W, X, Y and Z are heated with carbon. The results are shown.

reaction	W	X	Y	Z
metal + dilute hydrochloric acid	fizzing	fizzing	violent fizzing	no reaction
metal oxide + carbon and heat	no reaction	metal produced	no reaction	metal produced

What is the order of reactivity of the metals?

	most reactive  least reactive			
A	Y	W	X	Z
B	Y	X	W	Z
C	Z	W	X	Y
D	Z	X	W	Y

29 The diagrams show experiments involving the rusting of iron.



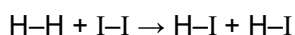
A student predicted the following results.

- 1 In test-tube P, the iron nails rust.
- 2 In test-tube Q, the iron nails do not rust.
- 3 In test-tube R, the iron nails do not rust.

Which predictions are correct?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1, 2 and 3

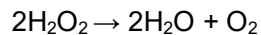
30 The formation of hydrogen iodide from hydrogen and iodine is an endothermic reaction.



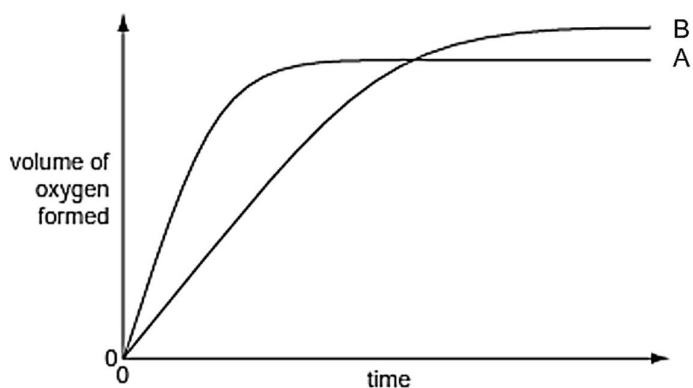
What may be deduced from this information?

- A The number of bonds broken is greater than the number of bonds formed.
- B The formation of H-I bonds absorbs energy.
- C The products possess less energy than the reactants.
- D The total energy change in bond formation is less than that in bond breaking.

- 31 Curve A was generated by monitoring the breakdown of 100 cm³ of 1.0 mol/dm³ hydrogen peroxide through the use of manganese(IV) oxide catalyst according to the equation:



What change in the initial experimental setup would produce curve B?



- A adding more deionised water
- B increasing the temperature at which the experiment was conducted
- C adding some 0.1 mol/dm³ hydrogen peroxide
- D adding more manganese(IV) oxide
- 32 How many of the following processes will lead to an increase in greenhouse gas emissions?
- decomposition of vegetation
 - fermentation of glucose
 - photosynthesis
 - polymerisation
 - respiration
- A 1
- B 2
- C 3
- D 4

33 Statement 1: The burning of fossil fuels containing sulfur is a cause of 'acid rain'.

Statement 2: Acid rain is formed from sulfur dioxide which is produced when sulfur compounds burn.

Which of the following is true?

- A** Both statements are correct and statement 2 explains statement 1.
- B** Both statements are correct, but statement 2 does not explain statement 1.
- C** Statement 1 is correct but statement 2 is incorrect.
- D** Statement 2 is correct but statement 1 is incorrect.

34 Octane is a hydrocarbon found in petrol.

Which statement about octane is correct?

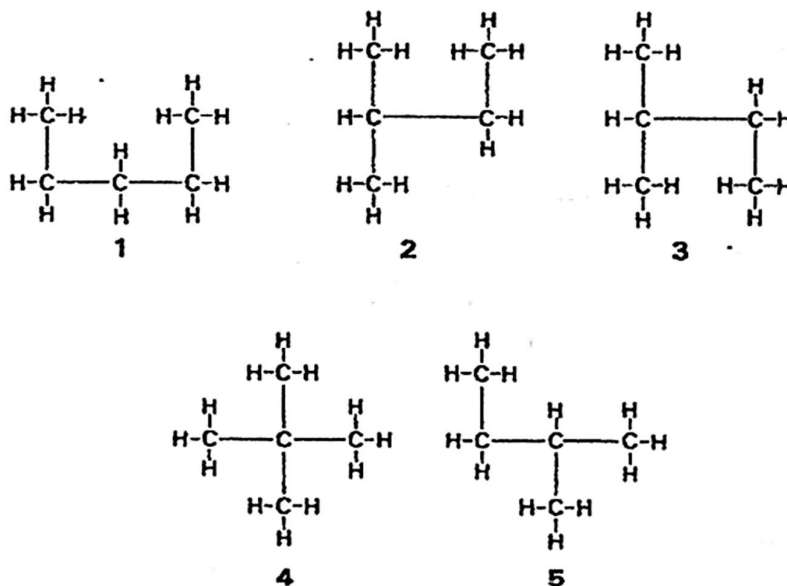
- A** It can be polymerised.
- B** It decolourises aqueous bromine.
- C** It has a lower boiling point than methane.
- D** It reacts with chlorine by substitution.

35 Which column describes ethane and which column describes ethene?

	hydrocarbon			
	1	2	3	4
state at room temperature	gas	gas	liquid	liquid
reaction with oxygen	burns	burns	burns	burns
reaction with aqueous bromine	no reaction	decolourises bromine	no reaction	decolourises bromine

- A** 1 (ethane) and 2 (ethene)
- B** 1 (ethane) and 3 (ethene)
- C** 2 (ethene) and 3 (ethane)
- D** 3 (ethane) and 4 (ethene)

36 Five structural formulas of pentane, C_5H_{12} are shown below.



How many isomers of pentane are there?

- A 2
- B 3
- C 4
- D 5

37 Which of the following equations represents a cracking reaction?

- A $C_4H_8 + H_2 \rightarrow C_4H_{10}$
- B $C_{20}H_{42} \rightarrow C_{10}H_{22} + 2C_5H_{10}$
- C $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$
- D $C_4H_9OH \rightarrow C_4H_8 + H_2O$

38 In the making of bubble tea, artificial flavours get their characteristic odour from various compounds, particularly esters. Pear flavour can be obtained by reacting butanoic acid with pentanol.

What substances are found in the final mixture?

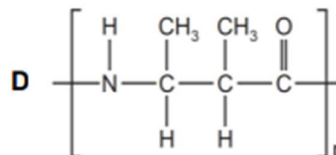
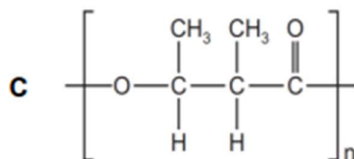
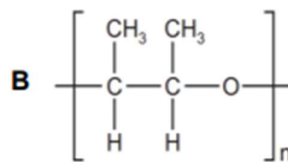
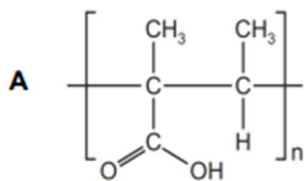
- A $CH_3(CH_2)_2COO(CH_2)_4CH_3$ and H_2O
- B $CH_3(CH_2)_3COO(CH_2)_3CH_3$ and H_2O
- C $CH_3(CH_2)_2COO(CH_2)_4CH_3$, H_2O , $C_5H_{11}OH$ and C_3H_7COOH
- D $CH_3(CH_2)_3COO(CH_2)_3CH_3$, H_2O , $C_5H_{11}OH$ and C_3H_7COOH

- 39 A student investigated the reaction of different vegetable oils with hydrogen. 100 cm³ of hydrogen was passed through 1 g samples of vegetable oils containing a suitable catalyst. The volume of hydrogen remaining after each reaction was recorded.

vegetable oil	volume of hydrogen remaining / cm ³
P	100
Q	87
R	63
S	0

Which vegetable oil(s) is/are unsaturated?

- A P only
 B Q and R only
 C Q, R and S only
 D S only
- 40 Which polymer structure has the same linkages as Terylene?



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The Periodic Table of Elements

Group																													
1	2													13	14	15	16	17	18										
														1 H hydrogen 1							2 He helium 4								
																			Key proton (atomic) number atomic symbol name relative atomic mass										
3 Li lithium 7	4 Be beryllium 9																							5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24																							13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84												
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131												
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids		72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —											
87 Fr francium —	88 Ra radium —	89–103 actinoids		104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganeson —											
lanthanoids		57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175													
actinoids		89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium 244	95 Am americium 243	96 Cm curium 247	97 Bk berkelium 247	98 Cf californium 251	99 Es einsteinium 252	100 Fm fermium 257	101 Md mendelevium 258	102 No nobelium 259	103 Lr lawrencium 262													