Question 220
Atomic Structure

The table refers to the electron distribution in the second shell of an atom with eight protons.

Which row is correct for this atom?

	orbital shape ∞		orbital shape ○	
	orbital type	number of electrons	orbital type	number of electrons
A	p	2	s	4
B	p	4	s	2
C	s	2	p	4
D	s	4	p	2

(Question 3 of Paper 1, Variant 3,Summer, 2018)

Hide Answer

Answer

B

Question 221
Atomic Structure

The structure of metals is considered to be positive ions surrounded by delocalised electrons.

The melting points of the metals in Period 3 increase with increasing atomic number.

Which statements help to explain this trend from sodium to aluminium?

1 The charge on the metal ion increases.

2 There are more delocalised electrons per metal ion.

3 The radius of the metal ion decreases.

(Question 35 of Paper 1, Variant 3,Summer, 2018)

Hide Answer

Answer

A

Atomic Structure

Materials can be classified by their chemical structures. Four common types of structure are metallic, ionic, simple molecular and giant molecular.

Some physical properties of four substances are shown in the table.

Which substance has a simple molecular structure?

	melting point /°C	effect of adding water	electrical conductivity
A	64	reacts	good when solid
B	113	insoluble	always poor
C	767	soluble	good when solid
D	1600	insoluble	always poor

(Question 9 of Paper 1, Variant 2,Summer, 2018)

Hide Answer

Answer

B

Question 219

Atomic Structure

Neutrons are passed through an electric field. The mass of one neutron relative to $\frac{1}{12}$ the mass of a ^{12}C atom and any deflection in the electric field is recorded.

Which row is correct?

	mass of neutron	behaviour of beam of neutrons in an electric field
A	0	deflected
B	1	deflected
C	0	not deflected
D	1	not deflected

(Question 2 of Paper 1, Variant 3,Summer, 2018)

Hide Answer

Answer

D

Question 216
Atomic Structure

The electronic configuration of an atom of sulfur is $1s^2 2s^2 2p^6 3s^2 3p^4$.

How many valence shell and unpaired electrons are present in one sulfur atom?

	valence shell electrons	unpaired electrons
A	2	1
B	4	2
C	6	0
D	6	2

(Question 2 of Paper 1, Variant 2,Summer, 2018)

Hide Answer

Answer

D

Question 217
Atomic Structure

In which pairs do both species have the same number of electrons?

1 ^{35}Cl and ^{37}Cl

2 $^{35}Cl^-$ and ^{40}Ar

3 ^{40}Ar and $^{40}K^+$

(Question 32 of Paper 1, Variant 2,Summer, 2018)

Hide Answer

Answer

A

Question 214

Atomic Structure

Silicon is heated in an excess of chlorine, producing compound J.

Excess water is added to the sample of J produced.

Which row is correct?

	structure of J	Is HC*l* produced when water is added to J?
A	giant molecular	no
B	giant molecular	yes
C	simple molecular	no
D	simple molecular	yes

(Question 12 of Paper 1, Variant 1,Summer, 2018)

Hide Answer

Answer

D

Question 215

Atomic Structure

Which element has the **second** smallest atomic radius in its group and the **third** lowest first ionisation energy in its period?

A boron

B calcium

C magnesium

D sodium

(Question 13 of Paper 1, Variant 1,Summer, 2018)

Hide Answer

Answer

C

Question 216

Question 211
Atomic Structure

Which molecule contains a nitrogen atom with sp hybridised orbitals?

A $CH_3CH_2NH_2$ **B** HNO_3 **C** HCN **D** NH_3

(Question 4 of Paper 1, March, 2018)

Show Answer

Question 212
Atomic Structure

This question refers to isolated gaseous atoms.

In which atom are all electrons paired?

A Ba **B** Br **C** S **D** Si

(Question 1 of Paper 1, Variant 1,Summer, 2018)

Show Answer

Question 213
Atomic Structure

Element X has a higher first ionisation energy than element Y.

Two students state what they believe is one factor that helps to explain this.

student 1 "X has a higher first ionisation energy than Y because an atom of X has more protons in its nucleus than an atom of Y."

student 2 "X has a higher first ionisation energy than Y because X has a smaller atomic radius than Y."

Only **one** of the two students is correct.

What could X and Y be?

	X	Y
A	carbon	boron
B	magnesium	aluminium
C	oxygen	nitrogen
D	oxygen	sulfur

C. A. D

(Question 10 of Paper 1, Variant 1,Summer, 2018)

Question 209

Atomic Structure

The electronic configuration of the two outermost shells of an atom is $3s^2 3p^6 3d^5 4s^2$.

What is this atom?

A manganese

B phosphorus

C strontium

D vanadium

(Question 2 of Paper 1, March, 2018)

Hide Answer

Answer

A

Question 210

Atomic Structure

Chlorine reacts with **hot** aqueous sodium hydroxide.

Which oxidation states does chlorine show in the products of this reaction?

1 –1

2 +3

3 +1

(Question 35 of Paper 1, March, 2018)

Hide Answer

Answer

D

Question 211

Question 208

Atomic Structure

Bromine is extracted from sea-water.

In the final stages of the process two redox reactions take place.

$$Br_2(aq) + SO_2(g) + 2H_2O(l) \rightarrow 2HBr(aq) + H_2SO_4(aq)$$

$$2HBr(aq) + Cl_2(g) \rightarrow Br_2(g) + 2HCl(aq)$$

Which row is correct?

	strongest oxidising agent	⟶	weakest oxidising agent
A	Br_2	SO_2	Cl_2
B	Cl_2	Br_2	SO_2
C	Cl_2	SO_2	Br_2
D	SO_2	Br_2	Cl_2

(Question 17 of Paper 1, March, 2018)

Hide Answer

Answer

B

Question 209

Question 207

Atomic Structure

The composition of atoms and ions can be determined from knowledge of atomic number, nucleon number and charge.

(a) Complete the table.

atomic number	nucleon number	number of electrons	number of protons	number of neutrons	symbol
3		2			$^{6}_{3}Li^{+}$
		23	26	32	

[2]

(b) Boron occurs naturally as a mixture of two stable isotopes, ^{10}B and ^{11}B. The relative isotopic masses and percentage abundances are shown.

isotope	relative isotopic mass	abundance / %
^{10}B	10.0129	19.78
^{11}B	to be calculated	80.22

(i) Define the term *relative isotopic mass*.

.....

..... [2]

(ii) Calculate the relative isotopic mass of ^{11}B.

Give your answer to **six** significant figures. Show your working.

[2]

[Total: 6]

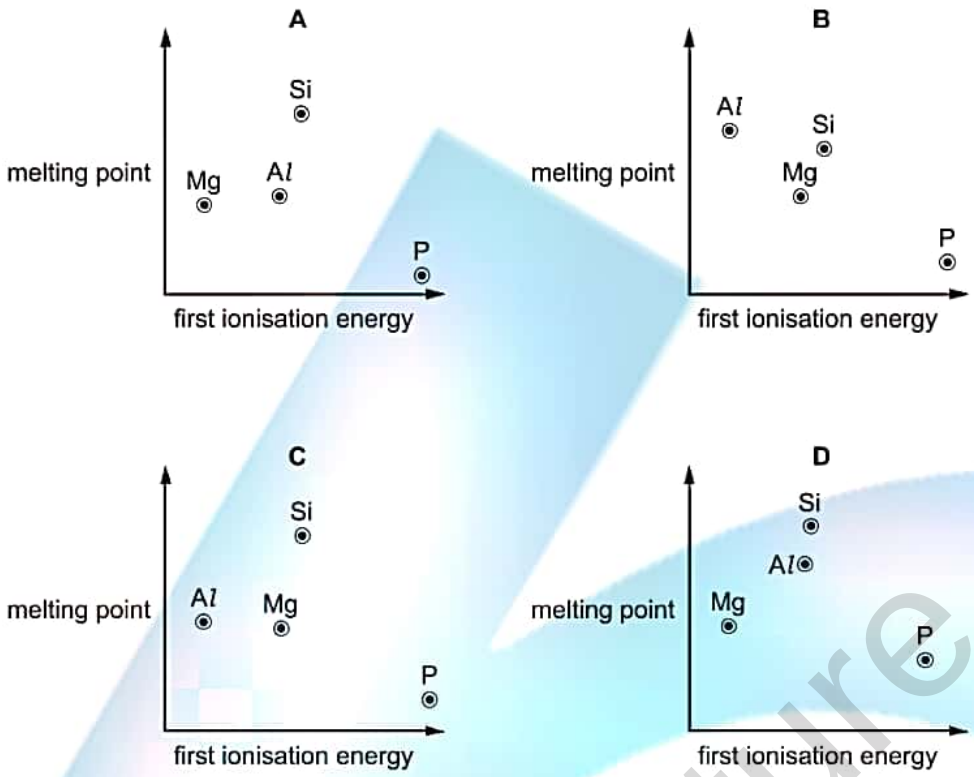
(Question 1 of Paper 2, Variant 2,Summer, 2017)

(a)			2

atomic number	nucleon number	number of electrons	number of protons	number of neutrons	symbol	
	6		3	3		1
					$^{56}_{26}Fe^{3+}$	1

ɔ)(i)	EITHER mass of an atom / isotope relative / compared to 1/12 (the mass) of (an atom of) C-12 OR on a scale in which a C-12 (atom / isotope) has (a mass of exactly) 12 (units) OR mass of one mol (of atoms) of an isotope relative / compared to 1/12 (the mass) of 1 mol of C-12 OR on a scale in which one mol C-12 (atom / isotope) has a mass of (exactly) 12 g	2 1 1
ɔ)(ii)	$\frac{(10.0129 \times 19.78) + (80.22x)}{100} = 10.8$	1
	x = 10.9941	1
	Total:	6

Which graph correctly shows the relative melting points of the elements Mg, Al, Si and P plotted against their relative first ionisation energies?



(Question 13 of Paper 1, Variant 3,Summer, 2017)

Hide Answer

Answer

C

Question 206

Atomic Structure

Which statements about the atoms ^{23}Na and ^{24}Mg are correct?

1 They have the same number of filled electron orbitals.

2 They have the same number of neutrons.

3 They are both reducing agents.

(Question 31 of Paper 1, Variant 3,Summer, 2017)

Hide Answer

Answer

C

Atomic Structure

An isolated gaseous atom of element X has paired electrons in at least one of its 3d orbitals and has a filled 4s subshell.

What could be the identity of element X?

1 iron

2 gallium

3 copper

(Question 31 of Paper 1, Variant 2,Summer, 2017)

Hide Answer

Answer

B

Question 204

Atomic Structure

The ion Y^{3-} contains 18 electrons and has a mass number of 31.

How many protons and neutrons does Y^{3-} contain?

	protons	neutrons
A	15	16
B	15	18
C	18	13
D	21	10

(Question 1 of Paper 1, Variant 3,Summer, 2017)

Hide Answer

Answer

A

Which property of an atom does **not** affect its first ionisation energy?

A the atomic radius

B the number of electron shells

C the number of neutrons

D the number of protons

(Question 4 of Paper 1, Variant 1,Summer, 2017)

Hide Answer

Answer

C

Question 201
Atomic Structure

In which species are the numbers of protons, neutrons and electrons **all** different?

A $^{19}_{9}F^-$ **B** $^{23}_{11}Na^+$ **C** $^{31}_{15}P$ **D** $^{32}_{16}S^{2-}$

(Question 1 of Paper 1, Variant 2,Summer, 2017)

Hide Answer

Answer

B

Question 202
Atomic Structure

The elements magnesium and sulfur each form doubly charged ions.

How do the atomic radii and ionic radii of these elements compare?

	atomic radius		ionic radius	atomic radius		ionic radius
A	Mg	>	Mg^{2+}	S	>	S^{2-}
B	Mg	>	Mg^{2+}	S	<	S^{2-}
C	Mg	<	Mg^{2+}	S	>	S^{2-}
D	Mg	<	Mg^{2+}	S	<	S^{2-}

B

(Question 12 of Paper 1, Variant 2,Summer, 2017)

Question 198

Atomic Structure

Beams of charged particles are deflected by an electric field. In identical conditions the angle of deflection of a particle is proportional to its charge / mass ratio.

In an experiment, protons are deflected by an angle of +15°. In another experiment under identical conditions, particle Y is deflected by an angle of –5°.

What could be the composition of particle Y?

	protons	neutrons	electrons
1	1	2	2
2	3	3	5
3	4	5	1

(Question 31 of Paper 1, Variant 1,Summer, 2017)

Hide Answer

Answer

B

Question 199

Atomic Structure

Graphene, graphite and the fullerene C_{60} are allotropes of carbon.

Which statements are correct for all three of these allotropes of carbon?

1 Delocalised electrons are present in the structure.

2 All bond angles are 120°.

3 It has a giant molecular crystalline lattice structure.

(Question 32 of Paper 1, Variant 1,Summer, 2017)

Hide Answer

Answer

D

Question 196

Atomic Structure

Why is the second ionisation energy of sodium larger than the second ionisation energy of magnesium?

A The attraction between the nucleus and the outer electron is greater in Na^+ than in Mg^+.

B The nuclear charge of Na^+ is greater than that of Mg^+.

C The outer electron of Na^+ is more shielded than the outer electron of Mg^+.

D The outer electron of Na is in the same orbital as the outer electron of Mg.

(Question 12 of Paper 1, Variant 1,Summer, 2017)

Hide Answer

Answer

A

Question 197

Atomic Structure

The mass spectrum of a sample of lithium shows that it contains two isotopes, ^6Li and ^7Li.

The isotopic abundances are shown in the table.

isotope	isotopic abundance
^6Li	7.42%
^7Li	92.58%

What is the relative atomic mass of this sample of lithium, given to three significant figures?

A 6.07 **B** 6.50 **C** 6.90 **D** 6.93

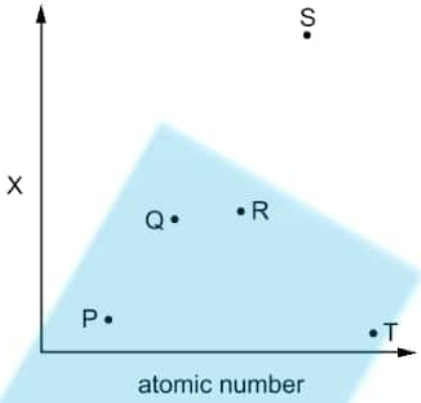
(Question 2 of Paper 1, Variant 1,Summer, 2017)

Hide Answer

Answer

D

The magnitude of property X of five elements from the third period of the Periodic Table, P, Q, R, S and T is shown. P, Q, R, S and T have consecutive atomic numbers. The letters do not represent the symbols of the elements.



Which row correctly identifies property X and element R?

	property X	element R
A	electrical conductivity	Al
B	electronegativity	Si
C	melting point	Al
D	melting point	Si

(Question 15 of Paper 1, March, 2017)

Hide Answer

Answer

C

Question 195

Atomic Structure

Which of these statements are always correct?

1 The sum of the oxidation numbers of all the atoms in a compound is zero.

2 The oxidation number of sodium in a salt is positive.

3 The oxidation number of chlorine in a compound is negative.

(Question 33 of Paper 1, March, 2017)

Hide Answer

Answer

B

Atomic Structure

Which isolated gaseous atom has a total of five electrons occupying spherically shaped orbitals?

A boron

B fluorine

C sodium

D potassium

(Question 5 of Paper 1, Variant 3,Summer, 2016)

Hide Answer

Answer

C

Question 192

Atomic Structure

Which ion has the same electronic configuration as Cl^-?

A F^- **B** P^+ **C** Sc^{3+} **D** Si^{4+}

(Question 1 of Paper 1, March, 2017)

Hide Answer

Answer

C

Question 193

Atomic Structure

Why does barium react more rapidly with cold water than magnesium does?

A Barium atoms are larger and form ions more easily than magnesium atoms.

B Barium floats on the surface of the water but magnesium sinks in the water.

C Barium hydroxide is less soluble than magnesium hydroxide.

D The sum of the 1st and 2nd ionisation energies of barium is more than that for magnesium.

(Question 14 of Paper 1, March, 2017)

Question 189

Atomic Structure

Why is the first ionisation energy of aluminium less than that of magnesium?

1 The outer electron in the aluminium atom is more shielded from the nuclear charge.

2 The outer electron in the aluminium atom is in a higher energy orbital.

3 The outer electron in the aluminium atom is further from the nucleus.

(Question 35 of Paper 1, Variant 3,Summer, 2016)

Hide Answer

Answer

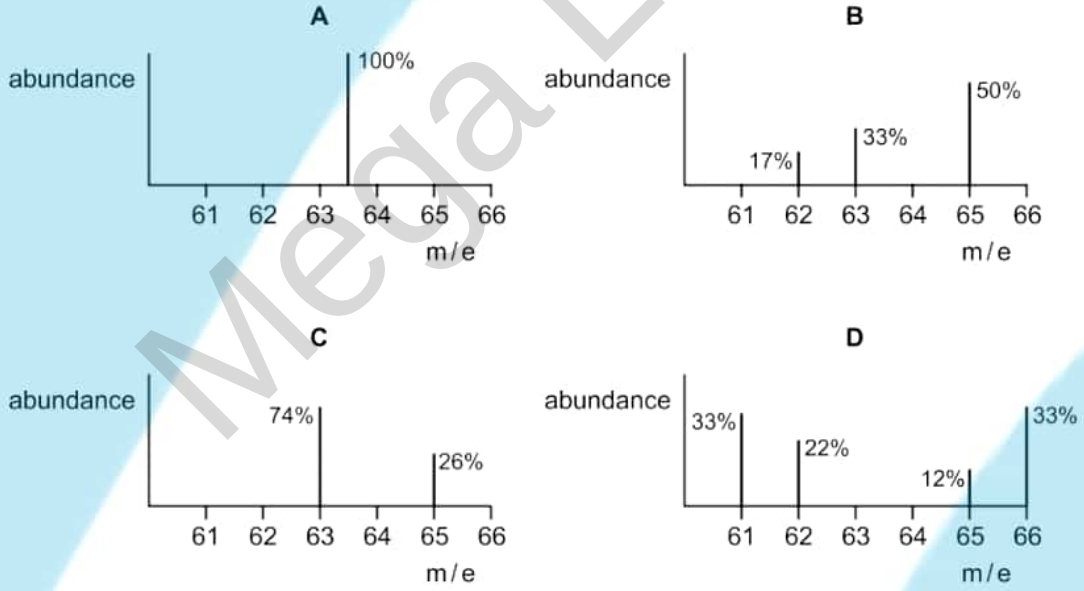
A

Question 190

Atomic Structure

The relative atomic mass of copper is 63.5.

Which chart is a correct mass spectrum that would lead to this value?



(Question 4 of Paper 1, Variant 3,Summer, 2016)

Hide Answer

Answer

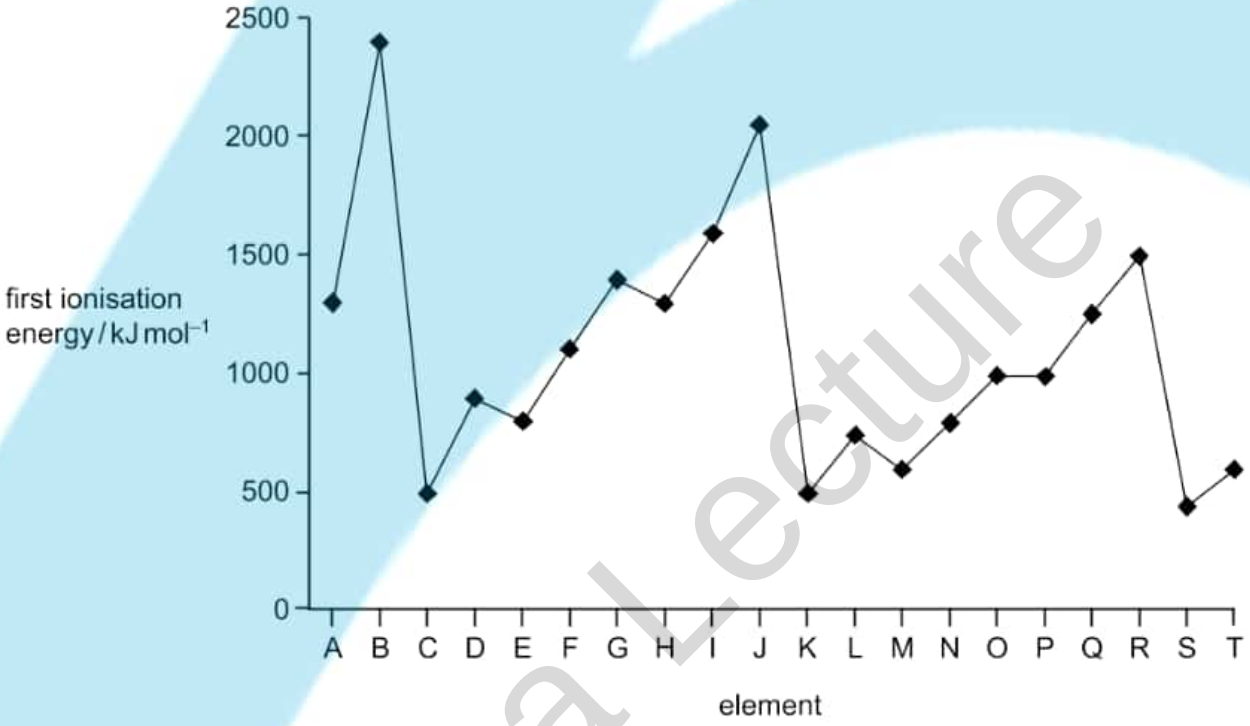
C

Question 188

Atomic Structure

The first ionisation energies of twenty successive elements in the Periodic Table are represented in the graph.

The letters given are not the normal symbols for these elements.



Which statements about this graph are correct?

1 Elements B, J and R are in Group 18 of the Periodic Table.

2 Atoms of elements D and L contain two electrons in their outer shells.

3 Atoms of elements G and O contain a half-filled p subshell.

(Question 35 of Paper 1, Variant 2,Summer, 2016)

Hide Answer

Answer

A

Atomic Structure

Elements X and Y are in the same group of the Periodic Table.

The table shows the first six ionisation energies of X and Y in $kJ\,mol^{-1}$.

	1st	2nd	3rd	4th	5th	6th
X	800	1600	2400	4300	5400	10400
Y	1000	1800	2700	4800	6000	12300

What could be the identities of X and Y?

	X	Y
A	antimony, Sb	arsenic, As
B	arsenic, As	antimony, Sb
C	selenium, Se	tellurium, Te
D	tellurium, Te	selenium, Se

(Question 3 of Paper 1, Variant 2,Summer, 2016)

Hide Answer

Answer

A

Question 187

Atomic Structure

Three elements, X, Y and Z, have electronic configurations as shown.

X	Y	Z
2,6	2,8,1	2,8,7

Which formulae represent compounds that conduct electricity in the liquid state?

1 YZ

2 Y_2X

3 Z_2X

(Question 32 of Paper 1, Variant 2,Summer, 2016)

Hide Answer

Answer

B

Question 184

Atomic Structure

Sodium and sulfur react together to form sodium sulfide, Na_2S.

How do the atomic radius and ionic radius of sodium compare with those of sulfur?

	atomic radius	ionic radius
A	sodium < sulfur	sodium > sulfur
B	sodium < sulfur	sodium < sulfur
C	sodium > sulfur	sodium > sulfur
D	sodium > sulfur	sodium < sulfur

(Question 12 of Paper 1, Variant 2,Summer, 2016)

Hide Answer

Answer

D

Question 185

Atomic Structure

Four electronic configurations are shown below. Three of these configurations belong to atoms of the elements chlorine, sodium and vanadium.

Which electronic configuration belongs to an atom of another element?

A $1s^2 2s^2 2p^6 3s^1$

B $1s^2 2s^2 2p^6 3s^2 3p^5$

C $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$

D $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$

(Question 2 of Paper 1, Variant 2,Summer, 2016)

Hide Answer

Answer

D

Question 182

Atomic Structure

When nuclear reactions take place, the elements produced are different from the elements that reacted. Nuclear equations, such as the one below, are used to represent the changes that occur.

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{144}_{56}Ba + {}^{89}_{36}Kr + 3\,{}^{1}_{0}n$$

The nucleon (mass) number total is constant at 236 and the proton number total is constant at 92.

In another nuclear reaction, uranium-238 is reacted with deuterium atoms, $^{2}_{1}H$. An isotope of a new element, **J**, is formed as well as two neutrons.

$$^{238}_{92}U + {}^{2}_{1}H \rightarrow \mathbf{J} + 2\,{}^{1}_{0}n$$

What is isotope **J**?

A ^{238}Np **B** ^{238}Pu **C** ^{240}Np **D** ^{240}Pu

(Question 4 of Paper 1, Variant 1,Summer, 2016)

Hide Answer

Answer

A

Question 183

Atomic Structure

Dicarbon monoxide, C_2O, is found in dust clouds in space. The structure of this molecule is C=C=O. The molecule contains no unpaired electrons.

How many lone pairs of electrons are present in a molecule of C_2O?

A 1 **B** 2 **C** 3 **D** 4

(Question 5 of Paper 1, Variant 1,Summer, 2016)

Hide Answer

Answer

C

Question 180

Atomic Structure

Why is the ionic radius of a chloride ion larger than the ionic radius of a sodium ion?

A A chloride ion has one more occupied electron shell than a sodium ion.

B Chlorine has a higher proton number than sodium.

C Ionic radius increases regularly across the third period.

D Sodium is a metal, chlorine is a non-metal.

(Question 12 of Paper 1, Variant 1,Summer, 2016)

Hide Answer

Answer

A

Question 181

Atomic Structure

X is a particle with 18 electrons and 20 neutrons.

What could be the symbol of X?

1 $^{38}_{18}Ar$

2 $^{40}_{20}Ca^{2+}$

3 $^{39}_{19}K^{+}$

(Question 31 of Paper 1, Variant 1,Summer, 2016)

Hide Answer

Answer

A

Atomic Structure

Which ion has both more electrons than protons and more protons than neutrons?
[H = $^{1}_{1}H$; D = $^{2}_{1}H$; O = $^{16}_{8}O$]

A D^- **B** H_3O^+ **C** OD^- **D** OH^-

(Question 3 of Paper 1, March, 2016)

Hide Answer

Answer

D

Question 178
Atomic Structure

Which molecules have an overall dipole moment?

1 carbon monoxide, CO
2 phosphine, PH_3
3 carbon dioxide, CO_2

(Question 31 of Paper 1, March, 2016)

Hide Answer

Answer

B

Question 179
Atomic Structure

Which species contains the smallest number of electrons?

A B^{3+} **B** Be^{2+} **C** H^- **D** He^+

d

(Question 4 of Paper 1, March, 2016)

Hide Answer