INKCHEMISTRY FLASHCARDS

Atomic structure

Unit C01 · 40 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions to learn and misconceptions to correct. These cards, and a check-yourself question for every lesson, run on the website with spaced-repetition scheduling, at inklearning.co.uk/chemistry/flashcards.

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DEFINITION

Define: Nucleon.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Define: Proton.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Define: Neutron.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Define: Electron.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Define: Atomic number.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Define: Mass number.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Define: Isotopes.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Define: Ion.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

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DEFINITION

A particle in the nucleus with a relative mass of 1 and a relative charge of +1.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

A proton or a neutron: either of the two particles found in the nucleus.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

A particle outside the nucleus with a relative mass of 1/1840 and a relative charge of -1.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

A particle in the nucleus with a relative mass of 1 and no charge.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

The total number of protons and neutrons in the nucleus of an atom, A.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

The number of protons in the nucleus of an atom, also called the proton number, Z.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

An atom or group of atoms that carries an overall charge because it has lost or gained electrons.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Atoms of the same element with the same number of protons but different numbers of neutrons.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

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DEFINITION

Define: Isoelectronic.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

SPOT THE ERROR

Say what is wrong with this claim:

Isotopes are the radioactive versions of an element, so a chlorine isotope must be something different from ordinary chlorine.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Define: Relative isotopic mass.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Define: Relative atomic mass.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Define: Relative molecular mass.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Define: M/z.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Define: Electron impact ionisation.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Define: Electrospray ionisation.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

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SPOT THE ERROR

Every chlorine atom is one of its isotopes. Ordinary chlorine is a mixture of ^{35}Cl and ^{37}Cl, atoms with the same 17 protons and 17 electrons and different numbers of neutrons, and neither is radioactive. Some isotopes are, such as carbon-14 and tritium, but most naturally occurring isotopes are stable.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

Having the same number of electrons, as Na^+, Ne and F^- do.

PROTONS, NEUTRONS, ELECTRONS AND ISOTOPES

DEFINITION

The weighted mean mass of an atom of an element relative to one twelfth of the mass of an atom of carbon-12, Ar.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

The mass of an atom of an isotope relative to one twelfth of the mass of an atom of carbon-12.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

The mass of an ion divided by its charge, equal to the relative mass of the ion when its charge is +1.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

The weighted mean mass of a molecule relative to one twelfth of the mass of an atom of carbon-12, Mr.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Ionisation in which a solution of the sample is sprayed from a needle at a high positive voltage, so that each molecule gains a proton, forming XH^+.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Ionisation in which high-energy electrons from an electron gun knock an electron off each gaseous particle, forming a 1+ ion.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

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DEFINITION

Define: Molecular ion.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Define: M+1 peak.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Define: M+2 peak.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

SPOT THE ERROR

Say what is wrong with this claim:

The relative atomic mass of chlorine is 35.5 because that is how heavy a chlorine atom is.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

Define: Shell.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: Subshell.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: Orbital.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: Electron configuration.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

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DEFINITION

A small peak one m/z unit above the molecular ion peak, from molecules that contain one carbon-13 atom.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

The ion formed when a whole molecule loses one electron, M^+, whose m/z gives the relative molecular mass.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

SPOT THE ERROR

No chlorine atom has a mass of 35.5. Chlorine is about 75% ^{35}Cl and 25% ^{37}Cl, and 35.5 is the mean of those masses weighted by abundance: (35 × 75 + 37 × 25) ÷ 100. A mass spectrum of chlorine atoms shows peaks at m/z 35 and 37 in a 3 : 1 ratio, and nothing at 35.5.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

A peak two m/z units above the molecular ion peak, from molecules that contain chlorine-37 or bromine-81 in place of the lighter isotope.

TIME-OF-FLIGHT MASS SPECTROMETRY AND RELATIVE ATOMIC MASS

DEFINITION

A division of a shell made of orbitals of equal energy, labelled s, p, d or f.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

A main energy level in an atom, numbered n = 1, 2, 3 outwards from the nucleus, holding up to $2n^2$ electrons.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

The arrangement of the electrons of an atom or ion in shells and subshells, written for example as $1s^2\ 2s^2\ 2p^6$.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

A region of space around the nucleus where there is a high probability of finding an electron; it holds up to two electrons, with opposite spins.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

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DEFINITION

Define: Pauli principle.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: Hund's rule.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: Block.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: Principal quantum number.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: Ground state.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: Excited state.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

SPOT THE ERROR

Say what is wrong with this claim:

Electrons fill shells two, then eight, then eight, and that is all there is to the arrangement.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

Define: First ionisation energy.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

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DEFINITION

Electrons fill the orbitals of a subshell singly, with parallel spins, before any orbital takes a pair.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

No orbital holds more than two electrons, and two electrons in the same orbital must have opposite spins.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

The number n of the shell an electron occupies, 1, 2, 3 and so on outwards from the nucleus.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

A region of the periodic table in which the highest-energy electron of each element is in the same type of subshell, s, p, d or f.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

A configuration in which one or more electrons occupy a higher-energy orbital than in the ground state.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

The lowest-energy electron configuration of an atom or ion, with each electron in the lowest available orbital.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

DEFINITION

The energy required to remove one electron from each atom in one mole of gaseous atoms to form one mole of gaseous 1+ ions.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

SPOT THE ERROR

Shells are divided into subshells, s, p, d and f, and the third shell holds 18 electrons, not 8. Its 3d subshell is filled after 4s, which is lower in energy, so potassium is [Ar] $4s^1$ and scandium is [Ar] $3d^1$ $4s^2$. The 2, 8, 8 pattern only describes the first 18 elements.

ELECTRON CONFIGURATION: SHELLS, SUBSHELLS AND ORBITALS

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DEFINITION

Define: Second ionisation energy.

DEFINITION

Define: Successive ionisation energies.

DEFINITION

Define: Nth ionisation energy.

DEFINITION

Define: Nuclear charge.

DEFINITION

Define: Atomic radius.

DEFINITION

Define: Shielding.

DEFINITION

Define: Spin-pair repulsion.

SPOT THE ERROR

Say what is wrong with this claim:

Ionisation energy goes up steadily across a period, so every element has a higher value than the one before it.

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DEFINITION

The energies needed to remove the electrons of an atom one at a time, first, second, third and so on.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

DEFINITION

The energy required to remove one electron from each ion in one mole of gaseous 1+ ions to form one mole of gaseous 2+ ions.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

DEFINITION

The total positive charge of the nucleus, equal to the number of protons in it.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

DEFINITION

The energy required to remove one electron from each ion in one mole of gaseous (n - 1)+ ions to form one mole of gaseous n+ ions.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

DEFINITION

The repulsion of an outer electron by the electrons in inner shells, which reduces the attraction of the nucleus it feels.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

DEFINITION

Half the distance between the nuclei of two bonded atoms of the same element.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

SPOT THE ERROR

The rise across a period has two dips. Aluminium is below magnesium because its outer electron is in 3p, higher in energy than 3s. Sulfur is below phosphorus because its fourth 3p electron is paired, and the repulsion in the pair makes it easier to remove. The dips are the evidence for subshells and orbitals.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

DEFINITION

The repulsion between two electrons in the same orbital, which makes one of them easier to remove than an unpaired electron.

IONISATION ENERGIES AND THE EVIDENCE FOR SUBSHELLS

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