Curriculum plan: Science combined

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INTENT:

“Look deep into nature, and then you will understand everything better”

Albert Einstein

The intent of the science department is to convey to students that science underpins everything.

At The King's, we study:

- **Physics** to be able to understand the fundamental principles that govern all Energy and matter in the Universe. Physics gives us tools to understand nature from the scale of a sub-a-tomic particles up to the inter-galactic scale of the universe;
- **Chemistry** to be able to understand the nature of substances: how they are composed, their behaviors, and their physical and chemical properties. Chemistry allows us to identify unknown substances, monitor concentrations and synthesize new chemicals. Above all, chemistry is about finding solutions to the problems that concern us and our surroundings;
- **Biology** to be able to understand life and thereby understand ourselves. Biology allows us an understanding od the amazing complexity of many life processes and mechanisms. Biology encourages us to seek out reasons for strange, surprising and sometimes usual observations.

Science provides some incredibly challenging topics helping to gauge an awareness of topical issues and their impact on the climate, earth as well as human growth.

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Please click on the icons to access our online portal where you can learn more about each topic*

9

Half term points

AUTUMN 1

Cell Biology

Learning to include:
Cell structure and transport
- the use of microscopes
- animal and plant cells
- transport of substances
- exchanging materials

Cell Division
- mitosis
- growth and differentiation
- stem cells

AUTUMN 2

Infection and response

Learning to include:
Communicable diseases
- health and disease
- preventing infections
- viral diseases
- bacterial diseases
- diseases caused by fungi and protists
- the human defence response
- growing bacteria
- plant diseases and defence

Preventing and treating disease
- vaccinations
- antibiotics and painkillers
- discovering and developing drugs
- making and using monoclonal antibodies

Non-communicable disease
- cancer
- smoking and the risk of disease
- diet, exercise and diseases
- alcohol and other carcinogens

SPRING 1

Atomic structure and the periodic table

Learning to include:
Atomic structure
- atoms
- chemical equations
- methods of separation
- history of the atom and its structure
- ions, atoms and isotopes
- electronic structure

The periodic table
- the development of the periodic table
- group 1
- group 7
- explaining trends
- the transition elements

SPRING 2

Quantitative Chemistry

Learning to include:
Chemical calculations
- relative masses and moles
- equation and calculations
- from masses to balanced equations
- expressing concentrations
- yield and atom economy

SUMMER 1

Energy

Learning to include:
Conservation and dissipation of energy
- changes in energy and energy conservation
- energy and work
- gravitational potential energy
- kinetic and elastic energy stores
- energy dissipation
- energy efficiency
- energy and power

Energy transfer by heating
- conduction
- infrared radiation
- specific heat capacity
- heating and insulating buildings

SUMMER 2

Particle model of matter

Learning to include:
Electric circuits
- current and charge
- potential difference and resistance
- component characteristics
- series and parallel circuits

Electricity in the home
- alternating current
- cables and plugs
- electrical power and potential difference
- electrical current and energy transfer

Molecules and matter
- density
- states of matter
- changes of state
- internal energy
- specific latent heat

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Organisation

Learning to include:
Organisation and the digestive system
- tissues and organs
- the human digestive system
- the chemistry of food
- catalysts and enzymes
- the factors affecting enzymes
- making digestion efficient

Organising animals and plants
- the blood
- the structure of blood vessels
- the structure and function of the heart
- helping the heart
- breathing and gaseous exchange
- transport system in plants
- evaporation and transpiration

Bioenergetics

Learning to include:
Photosynthesis
- the rate of photosynthesis
- how plants use glucose
- making the most of photosynthesis

Respiration
- aerobic respiration
- the body's response to exercise
- anaerobic respiration
- metabolism and the liver

Bonding, structure and matter

Learning to include:
Structure and bonding
- states of matter
- atoms and ions
- bonding: ionic and covalent
- giant ionic and giant covalent structures
- metallic bonding
- nanoparticles and their application

Chemical changes

Learning to include:
Chemical changes
- the reactivity series
- displacement reactions
- extracting metals
- making salts
- neutralisation and the PH scale

Electrolysis
- introduction to electrolysis
- changes at the electrodes
- the extraction of aluminium
- electrolysis of aqueous solutions

Topic 5: Energy Changes

learning to include:
energy changes
- exothermic and endothermic reactions
- using energy transfers
- reaction profiles
- bond energy calculations
- chemical cells and batteries
- fuel cells

Electricity

Learning to include:
Energy resources
- energy demands
- renewable energy: wind, water, sun and earth
- energy and the environment

Atomic structure

Learning to include:
Radioactivity
- atoms and radiation
- the discovery and changes to the nucleus
- alpha, beta and gamma radiation
- activity and half-life
- nuclear radiation in medicine
- nuclear fission
- nuclear fusion
- nuclear issues

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Half term points

10

AUTUMN 1 — Homeostasis and response

Learning to include:
The human nervous system
- the principles of homeostasis
- the structure and function of the nervous system
- reflex actions
- the brain
- the eye and problems

Hormonal coordination
- principles of hormonal control
- controlling blood glucose
- treating diabetes
- negative feedback
- human reproduction and artificial control of fertility
- infertility treatment
- plant hormones and their response

AUTUMN 2 — Inheritance, variation and evolution

Learning to include:
Reproduction
- Types of reproduction
- cell division in sexual reproduction
- DNA and the genome
- inheritance
- genetic disorders and screening for genetic disorders
- protein synthesis
- gene expression

Variation and evolution
- Variation
- natural selections
- selective breeding
- genetic engineering
- cloning

Genetics and evolution
- history of genetics
- theory of evolution
- evidence for evolution
- fossils and extinction
- classification
- the new system of classification

SPRING 1 — Ecology

Learning to include:
Adaptations, interdependence and competition
- the importance of communities
- distribution and abundance
- competition in animals and plants
- adaptations in animals and plants

Organising an ecosystem
- feeding relationships
- materials cycling
- the carbon cycle

Biodiversity and ecosystems
- the human population explosion
- land, water and air pollution
- deforestation and peat destruction
- global warming
- trophic levels
- food production and security
- biomass transfer

SPRING 2 — The rate and extent of chemical change

Learning to include:
Rates and equilibrium
- rates of reaction
- collision theory
- factors that affect rates of reactions
- reversible reactions
- dynamic equilibrium
- *the development of the periodic table*
- *Group 1*
- *Group 7*

SPRING 2 — Organic chemistry

Learning to include:
Crude oil and fuels
- hydrocarbons
- fractional distillation
- burning hydrocarbons
- cracking hydrocarbons

SUMMER 1 — Chemical analysis

Learning to include:
Chemical analysis
- pure substances and mixtures
- analysing chromatograms
- testing for gases: positive and negative ions
- instrumental analysis

SUMMER 1 — Chemistry of the atmosphere

Learning to include:
The Earth's atmosphere
- history of our atmosphere
- our evolving atmosphere
- greenhouse gases
- global climate change
- atmospheric pollutants

SUMMER 2 — Using resources

Learning to include:
The Earth's resources
- Finite and renewable resources
- water safe to drink
- treating waste water
- extracting metals from ores

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Half term points

AUTUMN 1

Forces

Learning to include:
Forces in balance
- vectors and scalars
- forces between objects
- resultant force
- levers and gears
- centre of mass
- parallelogram of force
- resolution of force
- moments and equilibrium

Motion
- speed-distance time graphs
- velocity and acceleration
- analysing motion graphs

Forces and motion
- Force and acceleration
- Weight and terminal velocity
- Force and braking
- Momentum
- Forces and elasticity
- Impact forces
- Safety first

AUTUMN 2

Waves

Learning to include:
Wave properties
- the nature of waves
- the properties of waves
- reflection and refraction
- seismic waves
- ultrasound

Electromagnetic waves
- The electromagnetic spectrum
- Light, infra-red, microwaves and radio waves
- Communication
- UV, X-rays and gamma rays
- Using X-rays in medicine

Magnetism and Electromagnetics

Learning to include:
- magnetic fields
- magnetic fields with electric currents
- the motor effect

SPRING 1

Required Practicals

Biology
Learning to include:
- cell division
- organisation and the digestive system
- photosynthesis
- respiration
- variation and evolution
- Genetics and evolution

Chemistry

Learning to include:
- structure and bonding
- chemical calculations
- electrolysis
- energy changes
- rates and equilibrium
-

Physics
Learning to include:
- electric circuits
- radioactivity
- forces and motion
- electromagnetism

SPRING 2

Required Practicals

Biology
Learning to include:
- using a light microscope
- investigating the effect of a range of concentration on osmosis
- food tests
- the effect of PH on the rate of reactions of amylase enzymes
- investigating the effect of light intensity on the rate of photosynthesis
- investigating antiseptics

Chemistry
Learning to include:
- preparing a salt from an insoluble base
- investigating electrolysis of a solution
- investigating temperature change

Physics
Learning to include:
- determining specific heat capacity
- investigating thermal insulators
- investigating resistance
- investigating electrical components
- calculating densities

SUMMER 1

Required Practicals

Biology
Learning to include:
- Investigate the effect of a factor on human reaction time
- measure the population size of a common species in a habitat
- investigating the effect of gravity on seedlings
- investigating the decay of milk

Chemistry
Learning to include:
- investigating the effect of concentration on the rate of a reaction
- calculating R_f values
- purifying and testing water

Physics
Learning to include:
- investigating the relationships between force and extension for a spring
- investigating the relationship between force and acceleration
- investigating plane waves in a ripple tank and waves in a solid
- investigating infrared radiations

SUMMER 2

Grade range end point:

9-1

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