Science

The school follows the Kent Science Scheme of work, specifically designed to address the Primary National Curriculum. During each key stage, pupils complete projects focused on an area of science as part of their curriculum. The projects are organised into a two-year rolling programme. Pupils learn specific knowledge in each project and deepen their understanding across each key stage, including the use of key concepts and the development of key vocabulary.

National Curriculum Aims
The national curriculum for science aims to ensure that all pupils: • develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics • develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them • are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future.

Throughout the years of compulsory schooling, schools should, through their science education programmes, aim systematically to develop and sustain learners' curiosity about the world, enjoyment of scientific activity and understanding of how natural phenomena can be explained. Science education should provide every student equally with opportunities that enable them to take an informed part in decisions, and to take appropriate actions, that affect their own wellbeing and the wellbeing of others and the
environment. It should aim to develop:

- understanding of a set of big ideas in science which include ideas of science and ideas about science and its applications
- scientific capabilities concerned with gathering and using evidence
- scientific attitudes and dispositions.

Working with Big Ideas of Science Education, 2015, Edited by Wynne Harlen

Key Concepts
In science pupils explore the following key concepts:

Asking questions	**Identifying and classifying**
Making predictions/hypothesising	**Gathering and recording data**
Planning and setting up different types of enquiries	**Presenting results**
Using equipment	**Providing explanations**
Observing and measuring	**Forming conclusions**

	Animals including humans (all)	Everyday Materials/ Rocks (1, 2, 3, 4, 5,)	Living Things and Their habitats (2, 4, 5, 6)	Forces and Magnets (3, 5) / Sound (4)	Light (3, 6)	Electricity (4, 6) Earth and Space (5)	Plants (1, 2, 3) Evolution (6)
Year 1	Identify/name a variety of common animals that are birds, fish, amphibians, reptiles and mammals. Identify/name a variety of common animals that are carnivores, herbivores and omnivores. Describe/compare the structure of a variety of common animals (birds, fish, amphibians, reptiles and mammals, and including pets). Identify, name draw and label the basic parts of the human body and say which parts of the body is associated with each sense.	Distinguish between an object and the material from which it is made. Identify and name a variety of everyday materials, including wood, plastic, glass, water and rock. Describe the simple physical properties of a variety of everyday materials. Compare and group together a variety of everyday materials on the basis of their physical properties.					Identify and name a variety of common plants, including garden plants, wild plants and trees, and those classified as deciduous and evergreen Identify and describe the basic structure of a variety of common plants including roots, stem/trunk, leaves and flowers.
Year 2	Notice that animals, including humans, have offspring which grow into adults Find out about and describe the basic needs of animals, including humans, for survival (water, food and air) Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.	Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.	Explore and compare the differences between things that are living, dead, and things that have never been alive Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other. Identify and name a variety of plants and animals in their habitats, including micro-habitats Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.				Observe and describe how seeds and bulbs grow into mature plants Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.

Year 3	Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat Identify that humans and some animals have skeletons and muscles for support, protection and movement.	Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties Describe in simple terms how fossils are formed when things that have lived are trapped within rock Recognise that soils are made from rocks and organic matter.		Compare how things move on different surfaces Notice that some forces need contact between two objects, but magnetic forces can act at a distance Observe how magnets attract or repel each other and attract some materials and not others Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials Describe magnets as having two poles Predict whether two magnets will attract or repel each other, depending on which poles are facing.	Recognise that they need light in order to see things and that dark is the absence of light Notice that light is reflected from surfaces Recognise that light from the sun can be dangerous and that there are ways to protect their eyes Recognise that shadows are formed when the light from a light source is blocked by a solid object Find patterns in the way that the sizes of shadows change.		Identify and describe the functions of different parts of plants; roots, stem, leaves and flowers. Explore the requirements of plants for life and growth (air, light, water, nutrients from soil and room to grow) and how they vary from plant to plant. Investigate the ways in which water is transported within plants. Explore the role of flowers in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.
Year 4	Describe the simple functions of the basic parts of the digestive system in humans Identify the different types of teeth in humans and their simple functions Construct and interpret a variety of food chains, identifying producers, predators and prey.	Compare and group materials together, according to whether they are solids, liquids or gases Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	recognise that living things can be grouped in a variety of ways explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment recognise that environments can change and that this can sometimes pose dangers to living things.	Identify how sounds are made, associating some of them with something vibrating Recognise that vibrations from a sound travel through a medium to the ear. Find patterns between the pitch of a sound and features of the object that produced it Find patterns between the volume of a sound and the strength of the vibrations that produced it. Recognise that sounds get fainter as the distance from the sound source increases.		Identify common appliances that run on electricity Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit Recognise some common conductors and insulators, and associate metals with being good conductors.	

Year 5	Describe the changes as humans develop from birth to old age.	Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets Understand that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic Demonstrate that dissolving, mixing and changes of state are reversible changes Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.	Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird Describe the life process of reproduction in some plants and animals.	Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object Identify the effects of air resistance, water resistance and friction, that act between moving surfaces Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.		Describe the movement of the Earth, and other planets, relative to the Sun in the solar system Describe the movement of the Moon relative to the Earth Describe the Sun, Earth and Moon as approximately spherical bodies Use the idea of the Earth's rotation to explain day and night and the apparent movement of the Sun across the sky.	
Year 6	Identify and name the main parts of the human circulatory system, and explain the functions of the heart, blood vessels and blood Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function Describe the ways in which nutrients and water are transported within animals, including humans.		Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals Give reasons for classifying plants and animals based on specific characteristics.		Recognise that light appears to travel in straight lines Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.	Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches Use recognised symbols when representing a simple circuit in a diagram**.**	Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Biology:

Understand plants
Understand animals and humans
Investigate living things
Understand evolution and inheritance

Physics:

Understand movement, forces and magnets
Understand the Earth's movement in space
Investigate light and seeing
Investigate sound and hearing
Understand electrical circuits

Chemistry:

Investigate materials

Deepening Understanding
When learning during the science projects pupils will deepen their knowledge of the following 'Big Ideas', the learning from which will contribute towards children's understanding of objects, phenomena and relationships in the natural world. **All matter in the Universe is made of very small particles-**Chemistry **5-7** All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances, is called matter because it has mass, and therefore weight on Earth, and takes up space. Different materials are recognisable by their properties, some of which are used to classify them as being in the solid, liquid or gas state, and to identify their suitability for different purposes. **7-11** When some substances are combined they form a new substance (or substances) with properties that are different from the original ones. Other substance simply mix without changing permanently and can often be separated again. At room temperature, some substances are in the solid state, some in the liquid state and some in the gas state. The state of many substances can be changed by heating or cooling them. The amount of matter does not change when a solid melts or a liquid evaporates. **Changing the movement of an object requires a net force to be acting on it-** Physics 5-7 Forces can push, pull or twist objects, making them change their motion or shape. Forces act in particular directions. Equal forces acting in opposite directions in the same line cancel each other and are described as being in balance. The movement of objects is changed if the forces acting on them are not in balance. 7-11 The speed of a moving object is a measure of how far it would travel in a certain time. How quickly an object's motion is changed depends on the force acting and the object's mass. The greater the mass of an object, the longer it takes to speed it up or slow it down, a property of mass described as inertia. **The total amount of energy in the Universe is always the same but can transferred from one energy store to another during an event-** Chemistry / Physics 5-7 There are various ways of causing an event or bringing about change in objects or materials. Objects can be made to change their movement by pushing or pulling. Heating can cause change, as in cooking, melting solids or changing water to vapour. 7-11 Electricity can make light bulbs glow. Wind can rotate the blades of wind turbines. In all these changes, energy is transferred from one object, which is an energy source or resource, to another. Fuels such as oil, gas, coal and wood are energy resources. Some energy resources are renewable, such as those produced by wind, waves, sunlight and tides, others are non-renewable such as from burning fossil fuels with oxygen. **Organisms are organised on a cellular basis and have a finite life span-** Biology 5-7 There is a wide variety of living things (organisms), including plants and animals. They are distinguished from non-living things by their ability to move, reproduce and react to certain stimuli. To survive they need water, air, food, a way of getting rid of waste and an environment which stays within a particular range of temperature.

7-11

Although some do not appear to be active, all will at some stage carry out the life processes of respiration, reproduction, feeding, excretion, growth and developments and all will eventually die.

Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms- Biology

5-7

All living things need food as their source of energy as well as air, water and certain temperature conditions. Plants containing chlorophyll can use sunlight to make the food they need and can store food that they do not immediately use. Animals need food that they can break down, which comes either directly by eating plants (herbivores) or by eating animals (carnivores) which have eaten plants or other animals.

7-11

Animals are ultimately dependent on plants for their survival. The relationships among organisms can be represented as food chains and food webs. Some animals are dependent on plants in other ways as well as for food, for example for shelter and, in the case of human beings, for clothing and fuel. Plants also depend on animals in various ways. For example, many flowering plants depend on insects for pollination and on other animals for dispersing their seeds.

Year Group Learning Expectations	
Year 1	**Plants** • Know the names of a variety of common wild and garden plants, including deciduous and evergreen tree • Know and describe the basic structure of a variety of common flowering plants, including trees **Animals including humans** • Know the names a variety of common animals including fish, amphibians, reptiles, birds and mammals • Know the names of a variety of common animals that are carnivores, herbivores and omnivores • Know and describe the differences between the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets) • Know the basic parts of the human body and say which part of the body is associated with each sense **Everyday Materials** • Know the difference between an object and the material from which it is made • Know the names of a variety of everyday materials, including wood, plastic, glass, metal, water, and rock • Know and can describe the simple physical properties of a variety of everyday materials • Know how to compare and group together a variety of everyday materials on the basis of their simple physical properties. **Seasonal Changes** • Know about changes across the four seasons • Know about and describe weather associated with the seasons and how day length varies.
Year 2	**Living things and their habitats** • Know the differences between things that are living, dead, and things that have never been alive • Know that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other • Know the names of a variety of plants and animals in their habitats, including micro-habitats

	• Know and describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food. **Plants** • Know and describe how seeds and bulbs grow into mature plants • Know and describe how plants need water, light and a suitable temperature to grow and stay healthy **Animals, including humans** • Know that animals, including humans, have offspring which grow into adults • Know and describe the basic needs of animals, including humans, for survival (water, food and air) • Know and describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene **Uses of everyday materials** • Know about the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses • Know that the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching
Year 3	**Plants** • Know and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers • Know the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant • Know the way in which water is transported within plants • Know the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal **Animals, including humans** • Know that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat • Know that humans and some other animals have skeletons and muscles for support, protection and movement. **Rocks** • Know about the differences between different kinds of rocks on the basis of their appearance and simple physical properties • Know in simple terms how fossils are formed when things that have lived are trapped within rock • Know that soils are made from rocks and organic matter **Light** • Know that we need light in order to see things and that dark is the absence of light • Know that light is reflected from surfaces • know that light from the sun can be dangerous and that there are ways to protect their eyes • Know that shadows are formed when the light from a light source is blocked by a solid object • Know the way that the size of shadows change and can find patterns **Forces and magnets** • Know and can compare how things move on different surfaces • Know that some forces need contact between two objects, but magnetic forces can act at a distance • Know how magnets attract or repel each other and attract some materials and not others and can describe magnets as having two poles • Know whether two magnets will attract or repel each other, depending on which poles are facing. • Know how to compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials
Year 4	**Living things and their habitats** • Know that living things can be grouped in a variety of ways • Know how to use classification keys to help group, identify and name a variety of living things in their local and wider environment • Know that environments can change and that this can sometimes pose dangers to living things

	Animals, including humans • Know and describe the simple functions of the basic parts of the digestive system in humans • Know the different types of teeth in humans and their simple functions • Know how to construct and interpret a variety of food chains, identifying producers, predators and prey **States of matter** • Know how to compare and group materials together, according to whether they are solids, liquids or gases • Know that some materials change state when they are heated or cooled, and can measure or research the temperature at which this happens in degrees Celsius (°C) • Know the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. **Sound** • Know how sounds are made, associating some of them with something vibrating • Know that vibrations from sounds travel through a medium to the ear • Know about the relationship between the pitch of a sound and features of the object that produced it • Know about the relationship between the volume of a sound and the strength of the vibrations that produced it • Know that sounds get fainter as the distance from the sound source increases. **Electricity** • Know common appliances that run on electricity • Know how to construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers • Know whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery • Know that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit • Know some common conductors and insulators, and associate metals with being good conductors.
Year 5	**Living things and their habitats** • Know and describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird • Know and describe the life process of reproduction in some plants and animals. **Animals, including humans** • Know and describe the changes as humans develop to old age. **Properties and changes of materials** • Know, compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets • Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution • Know how mixtures might be separated, including through filtering, sieving and evaporating using my knowledge of solids, liquids and gases • Know the reasons for the particular uses of everyday materials, including metals, wood and plastic, based on evidence from comparative and fair tests • Know and can demonstrate that dissolving, mixing and changes of state are reversible changes • Know and can explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda **Earth and Space** • Know and describe the movement of the Earth, and other planets, relative to the Sun in the solar system • Know and describe the movement of the Moon relative to the Earth • Know and can describe the Sun, Earth and Moon as approximately spherical bodies • Know and can explain day and night and the apparent movement of the sun across the sky using the idea of the Earth's rotation **Forces** • Know and can explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object • Know the effects of air resistance, water resistance and friction, that act between moving surfaces

	• Know that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect
Year 6	**Living things and their habitats** • Know and can describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals • Know and can give reasons for classifying plants and animals based on specific characteristics **Animals, including humans** • Know the names of the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood • Know the impact of diet, exercise, drugs and lifestyle on the way their bodies function • Know and can describe the ways in which nutrients and water are transported within animals, including humans **Evolution and inheritance** • Know that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago • Know that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents • Know how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution **Light** • Know and can explain that objects are seen because they give out or reflect light into the eye using the idea that light travels in straight lines • Know and can explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes • Know and can explain why shadows have the same shape as the objects that cast them using the idea that light travels in straight lines **Electricity** • Know the association between the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit • Know and can compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches • Know how to use recognised symbols when representing a simple circuit in a diagram.

Two-year Rolling Programme

Year Group	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
A 1/2	Biology Seasonal Changes - *Seasons- observe weather*	Biology Animals including humans 1 – Humans/my body *Seasons- observe weather*		Biology Plants *Seasons- observe weather*	Chemistry Everyday Materials/explore what toys are made from *Seasons- observe weather*	Biology Animals including humans 2 – animals- identify and compare *Seasons- observe weather*
B 1/2	Biology Animals including humans 2 – human health	Chemistry Uses of everyday materials		Biology Plants	Biology Animals including humans 1 – survival and growth	Biology All living things and their habitats
A 3/4	Biology Animals including humans	Physics Light		Physics Forces and magnets	Chemistry Rocks	Biology Plants
B 3/4	Biology Animals including humans	Physics Sound		Chemistry States of Matter	Physics Electricity	Biology Living things in their habitats
A 5/6	Biology Animals including humans	Physics Earth and Space		Chemistry Properties and changes in materials	Physics Forces	Biology Living things and their habitats
B 5/6	Biology Evolution and inheritance	Physics Light		Biology Animals including humans	Biology Living things and their habitats	Physics Electricity

Additional Key Vocabulary which compliments key vocabulary lists included in Kent Primary Science Scheme of Work (Andrew Berry)

Topic	Year 1/2	Year 3/4	Year 5/6

Animals including humans	Reptiles, Mammals, Amphibians (+ examples of each) Herbivore, Omnivore, Carnivore, Survival, Offspring, Calf, Exercise, Hygiene	Muscles, Contract, Relax, Joints, Nutrition, Nutrients, Carbohydrates, Protein, Fats, Fibre, Vitamins, Minerals, Invertebrates, Vertebrates, Digestive system, Small Intestine, Large Intestine, Colon, Saliva, Canine, Incisor, Molar Producers	Foetus, Embryo, Womb, Gestation, Development, Puberty, Life Cycle, Fertilisation, Reproduce, Life Expectancy, Skeletal, Muscle, Digest, Circulatory system, Blood vessels, Lifestyle, Nutrients, Substances
Plants	Deciduous, Evergreen, Blossom, Petals, Roots,	Nutrients, Reproduction, Transportation, Transpiration, Dispersal,	

	Bulb, Stem, Temperature, Growth	Pollination	
Living Things in their Habitats	Living, Habitat, Energy, Food chain, Predator, Prey, Woodland, Desert, Source, Adapt	Vertebrates, Invertebrates, Environment, Human impact	Life Cycle, Mammal, Reproduction, Amphibian, Offspring Classify Classification Domain kingdom phylum, Class, Family Genus, Species, Characteristics, Micro-organisms, Organism, Flowering, Non-flowering,
Evolution and Inheritance			Evolution, Adaption, Inherited Traits, Adaptive Traits, Natural Selection, Inheritance, Charles Darwin, Alfred Wallace, DNA, Variation,

			Offspring, Fossil
Everyday Materials including Rocks	Rough, Smooth, Stretchy, Stiff, Bending, Twisting, Stretching, Elastic, Foil Dull, Waterproof, Absorbent, Fabrics	Fossils, Sandstone, Granite, Marble, Rock Pumice, Crystals, Absorbent, Sedimentary, Organic matter, Grains Solid, Liquid, Gas, Evaporation, Condensation, Particles, Freezing, Solidify Changing State, Degrees Celsius, Water Cycle, Water Vapour	Properties, Solubility, Transparency, Electrical Conductor, Thermal Conductor, Magnets, Dissolve, Solution, Separate, Separating, Reversible Changes, Dissolving, Evaporation, Filtering, Sieving, Melting, Irreversible, Quantitative, Measurements, Conductivity, Insulation, Chemical
Forces and Magnets		Magnetic, Force, Attract, Repel, Friction,	Gravity, Air Resistance, Water Resistance, Friction, Surface,

		Poles, Magnetic Poles	Force, Effect, Accelerate, Decelerate, Mechanism, Pulley, Gear, Spring, Theory of gravitation Galileo Galilei, Isaac Newton
Light		Reflective, Reflection, Natural, Artificial	Refraction, Reflection, Spectrum, Rainbow, Travels, Straight, Reflect, Light Source, Object, Shadows, Mirrors, Periscope, Filters SEE ALSO YEAR FIVE EARTH AND SPACE
Seasonal Changes	Seasons Weather, Summer, Spring,		

	Autumn, Winter		
Electricity		Cells, Switches, Buzzers, Motor, Circuit, Series, Conductors, Insulators, Complete Circuit	Amps, Volts, Voltage, Cell, Circuit Diagram, Symbols
Sound		Vibration, Wave, Pitch, Tone, Percussion, Wood wind, Brass, Insulate	
Earth and Space			Earth, Sun, Moon, Orbit, Axis, Rotation, Spherical, Day, Night, Hemisphere, Season, Tilt,

			Phases of the Moon, Star, Constellation, Solar system, Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto