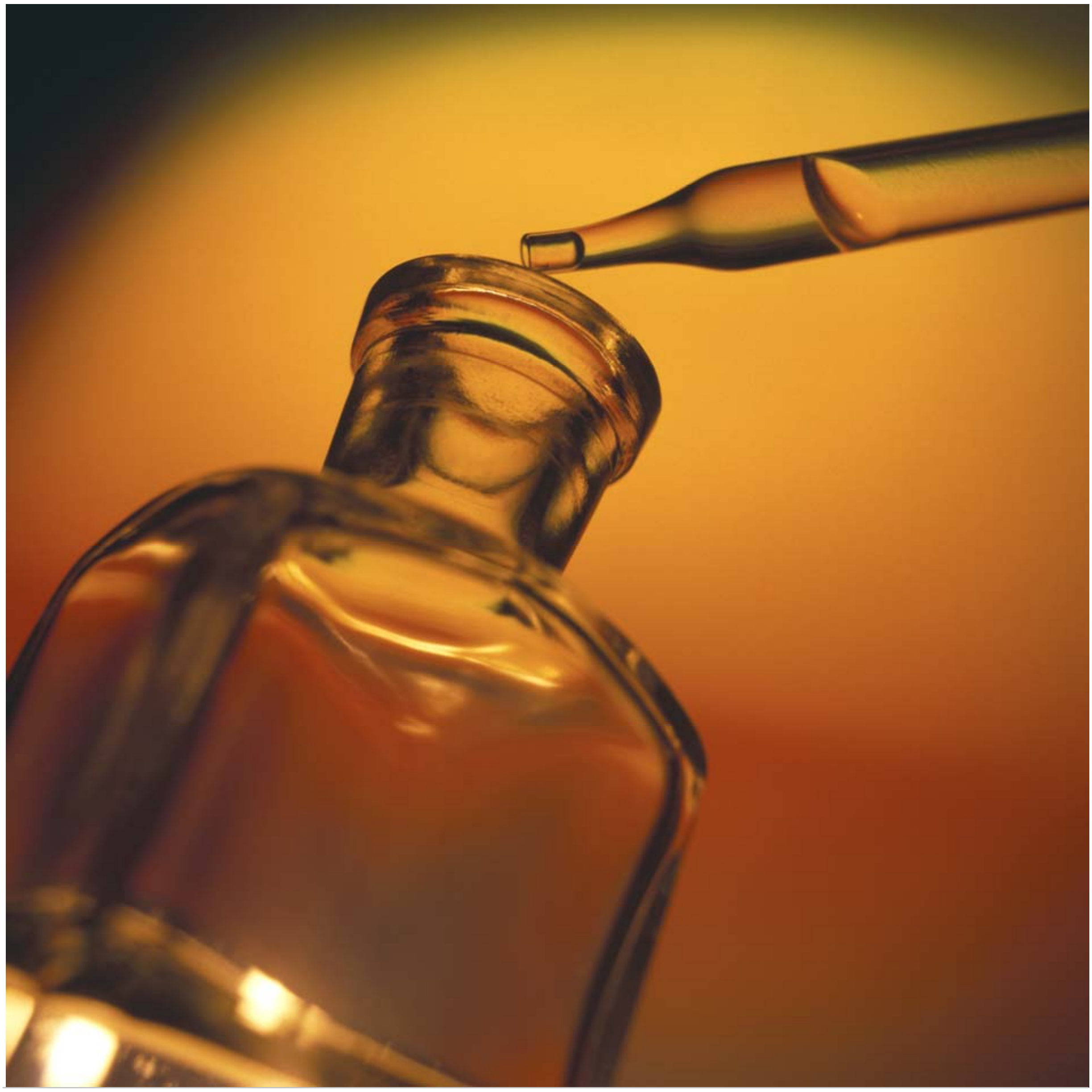
The Kingshurst Basic Route
for OCR Level 2 National in Science

USB Keys – Sample Content



Unit 1 Scheme.pdf - Adobe Acrobat Professional

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Bookmarks

Options

- UNIT 1: Best Practice in Science
- AIM
- AO1
- AO2
- AO3
- AO4
- AO5
- AO6

AO3 - PERFORM LABORATORY ACTIVITIES AND CARRY OUT TESTING OPERATIONS SAFELY

When ever you carry out practical work you must maintain a safe and clean environment by carrying out a risk assessment and produce a written assessment. Refer to the risk and safety symbols, phrases as well as the hazard cards.
Risk and Safety
Risk Assessment

In AO2 you would have collected, labelled and stored your samples so that they are not damaged or decomposed. These you will test.
The soil samples will need distilled water added to them and then shaken. The sample is then left for the water to settle out. The water is then used in the tests.
The water samples can be concentrated by careful evaporation to produce a more concentrated solution.

You will need to be able to carry out simple chemical analysis.
Chemical Tests for Anions
Chemical Tests for Cations
Task 1
Task 1 - Chemical Tests for Ions

You will need to carry out flame tests for cations.
Flame Tests for Cations
Task 2
Task 2 - Flame Tests for Cations

You will need to carry out microscopic identification by observing fine detail with a microscope. So you will need to be able to set up and use a light microscope.
Observing Fine Detail
Task 3
Task 3 - Observing Fine Detail with a Microscope

You will need to be able to carry out micro-organic identification by culturing a microorganism on an agar plating.
Culturing a Microorganism using Aseptic Technique
Task 4
Task 4 - Culturing a Microorganism using Aseptic Technique

You will need to test the pH of your samples.
Task 5
Task 5 - Using a pH Meter

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AO1 - IDENTIFYING THE STATUTORY REGULATIONS AND ORGANISATIONAL PROCEDURES TO MAINTAIN SAFETY

Maintain health and safety in work area
It is important that you realize the importance and legality of working safely. You should have an understanding of the basis of British health and safety law, which is the Health and Safety at Work Act 1974 and the relative importance of three components:

guidance
approved codes of practice
regulations when implementing health and safety

Whilst you are in education CLEAPSS is used to cover health and safety.
Health and Safety at Work Act 1974

A person that enforces the Health and Safety Act for local businesses is an Environmental Health Officer (EHO).
Case Study - EHO

Follow codes of practice
Organisations have created Codes of Practice so that the operators will maintain safety in their workplace even if an accident does occur. They will have set up safety regulations based on the Health and Safety Act and have first aid procedures.
First Aid

You must always be aware of the possibilities of an outbreak of fire, know how to prevent fire and the procedures if there is a fire.
Fire Prevention

Follow safety procedures
When ever you carry out a practical procedure you must identify possible risks and hazards. You need to be able to identify hazard symbols and be able to use hazard cards to be able to work safely.
Risk and Safety

An example of some hazard cards.
Hazard Cards

When ever you carry out a practical procedure you must refer to the hazard symbols and hazard cards and complete a risk assessment using the correct safety phrases.
Risk Assessment
This sheet can be used for every risk assessment undertake throughout the course.

Task 1
Create a pamphlet for a person coming to work in a laboratory.
Consider the procedures of the laboratory you work in but you must also refer to:

statutory regulations
safety procedures
codes of practice
consequences of non-compliance to any regulation or procedure

Unit 1 – Best Practice in Science
AO1 and AO3

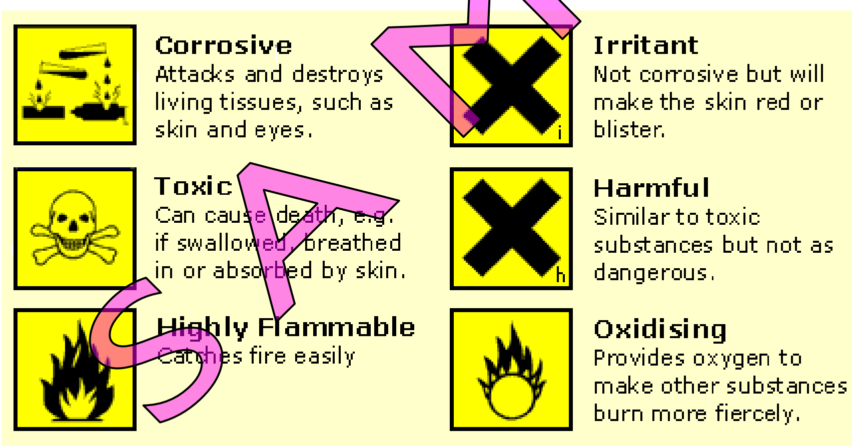
Risk and Safety Phrases

R20:	Harmful by inhalation
R21:	Harmful in contact with skin
R22:	Harmful if swallowed
R23:	Toxic by inhalation
R24:	Toxic in contact with skin
R25:	Toxic if swallowed
R26:	Very toxic by inhalation
R27:	Very toxic in contact with skin
R28:	Very toxic if swallowed

R34:	Causes burns
R35:	Causes severe burns
R36:	Irritating to eyes
R37:	Irritating to respiratory system
R38:	Irritating to skin

S1	Keep locked up
S7	Keep container tightly closed
S8	Keep container dry
S15	Keep away from heat
S16	Keep away from sources of ignition
S24	Avoid contact with eyes
S25	Avoid contact with skin
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S27	Take off immediately all contaminated clothing.
S36	Wear suitable protective clothing.
S37	Wear suitable gloves.
S39	Wear eye/face protection

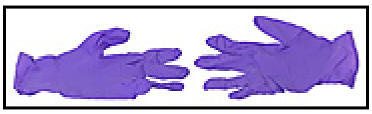
Hazard Symbols



Safety Clothing

SAFETY GOGGLES

SAFETY VISOR



PLASTIC GLOVES

Unit 1 – Best Practice in Science
AO1 and AO3

RISK ASSESSMENT

Department:		**Room Number:**
Brief summary of activity:		
List hazardous procedures and the hazard(s) relating to them	**Procedure**	**Hazard**
List the substances hazardous to health and the hazard(s) relating to them	**Substance**	**Hazard**
Risk and Safety phrases		
List who might be exposed to the hazard substance(s).	*(e.g. staff, students, visitors, cleaners)*	
Assessing the level of risk	**How severe is any injury or health effect likely to be?**	
	How likely is exposure to the hazard?	
	What is the overall level of risk? (Tick appropriate box – if risk is high further steps must be taken to minimum the risk of the procedure) ☐ High ☐ Medium ☐ Low	
Emergency Procedures	*(first aid actions, fire actions, spill action)*	
Disposal requirements		
Date:	**Name:**	**Signature**:

ACETONE (PROPANONE)

Highly flammable	Highly flammable vapour. Flash point 18 °C.
Irritant	Irritating to eyes, skin and respiratory system. Vapours may cause drowsiness and dizziness.

PREVENTION:

- Wear safety goggles.
- Ensure laboratory is well ventilated.
- Keep container in a well ventilated place.
- Keep away from naked flames and sparks.
- Do not breathe in the vapour.
- Store in suitable container (not plastic).

EMERGENCY PROCEDURE:

- **Splashed in eye:** Rinse immediately with water for at least 10 minutes and seek medical attention.
- **Spilt on floor:** Wear eye protection and gloves. Remove sources of ignition. Put mineral absorbent such as sand or vermiculite onto the spill and sweep up the solid. Rinse area thoroughly with water.
- **Spilt on skin or clothing:** Remove contaminated clothing. Wash off skin with plenty of water.

ACTIVITES USED IN: Esterification
Thin Layer Chromatography of Drugs/Inks
TLC of Sugars

This is not a comprehensive hazard card, for further information refer to CLEAPSS or MSDS.

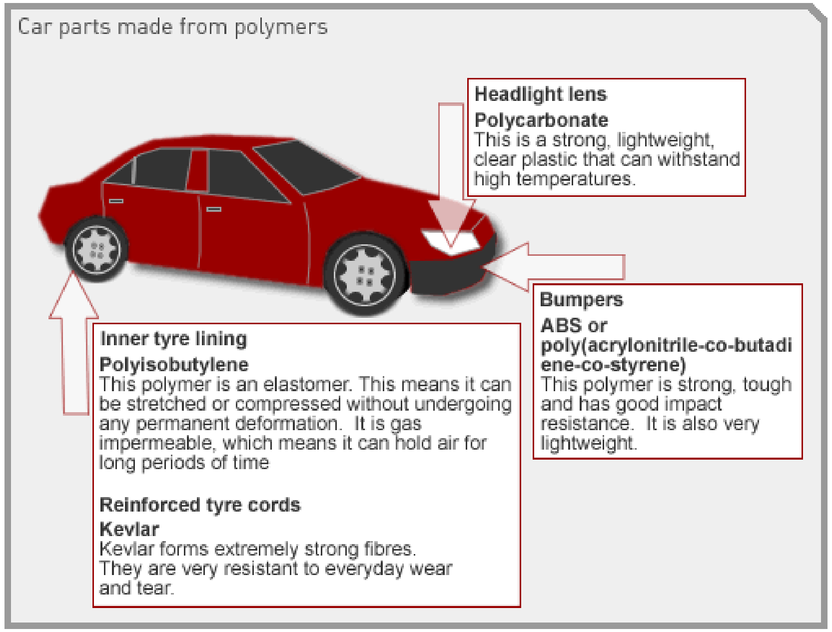
Fact File: SYNTHETIC POLYMERS

Find out:

1. Other names for synthetic polymers with examples.
2. The three categories polymers are classified into.
3. Applications of man-made polymers.
4. What polymerisation is.

Type your information into this box.

Source: www.wikipedia.org



The Formation of Polymers and Uses of Plastics

Find out:

1. What happens in the process called addition polymerisation.
2. Add details about each of the examples.

Poly(ethene)

Poly(propene)

Poly(chloroethene), **PVC,**

Polystyrene* is made from styrene*

Source: www.wpbschoolhouse.btinternet.co.uk

Unit 2 – Materials Science
AO2

Types of Materials

Perspex

Perspex is a clear glass-like plastic. It has strong resistance to outdoor environments, heat and ultraviolet radiation and will transmit 90% of daylight. Perspex is also much lighter, tougher and cheaper than glass. Perspex is used as a substitute for glass in aircraft glazing, roof lighting, advertising displays, windows and windscreens, vehicle tail lights, double glazing and protective shields as well as in the lenses of glasses.

Plastics

Plastics is a common name for a wide range of materials. Thermosetting plastics tend to be hard, rigid plastics which can withstand high temperatures. They are used for making objects which require durability. These include ship's hulls, heavy duty flooring and road surfacing, car tyres, heating pipes, adhesives and car and electrical parts.

Thermosoftening plastics tend to be a lot more flexible and mouldable. They include synthetic polymers such as nylon and polyester which can be easily woven. Thermoplastics are also used in packaging, plastic bags, footwear, guttering and piping, to name a few.

Polyester

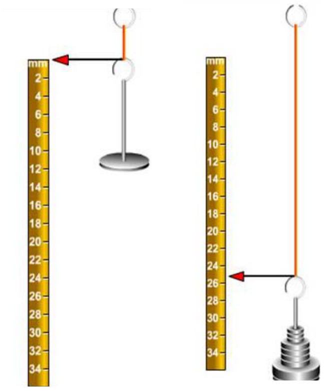
Polyester can be produced in two forms; thermoplastics and thermosets. Thermoplastic polyesters have long unlinked polymer chains. They have excellent electrical resistivity, are tough and discolour when subject to ultraviolet radiation. These polymers are used to produce synthetic fibres which are long, strong and can easily be woven into clothes. Thermosetting polyesters have interlinked polymer chains. These polyesters, with glass fibre as reinforcement, can be created with great tensile strength, similar to that of metals. Reinforced polyesters are used in hulls of boats, car bodies, wheelbarrows, helmets, swimming pools, fishing rods and archery bows because of their strength and toughness.

Polythene

Polythene is a thermoplastic material. There are two main types: low density (LDPE), which has a branched polymer chain structure and a fairly low tensile strength and high density (HDPE), with linear chains being stronger and stiffer. Both forms have good impermeability to gases and very low absorption rates for water. LDPE is used for bags, squeeze bottles, ballpoint pen tubing, and wire and cable insulation. HDPE is used for piping, toys and household ware.

Unit 2 – Materials Science
AO5 – Task 2

Find the Tensile Strength of 14-Gauge Copper Wire



Method

- Secure a clamp stand to the desk with a G-clamp.
- Secure a metre rule to the clamp stand.
- Attach a copper wire to the clamp stand, and a 10 N hook at the other end of the wire.
- Measure the diameter of the wire with vernier callipers.
- Make a pointer at the bottom of the copper wire at a 0 mark on a ruler.
- Record the mass added and the extension in mm of the wire.
- Record the maximum mass added before the wire broke.

Results

Load (N)	Extension (mm)

Diameter of wire =

Radius of wire =

Cross sectional area $= \Pi r^2 =$

Calculations

- Tensile strength (N mm^{-2}) $= \dfrac{\text{maximum load before breaking (N)}}{\text{original cross sectional area (mm}^2\text{)}}$
- Tensile strength (N mm^{-2}) =
- Tensile strength (N mm^{-2}) of 14 gauge copper wire =

Comparison of Energy Production

Fossil Fuelled Power Station

Energy conversions:

- Chemical energy in the fuel is burnt to release heat energy.
- Heat energy turns water to steam and its kinetic energy…
- Turns turbines connected to a generator.
- The generator converts kinetic energy to electrical energy.

Each conversion will transfer energy to the environment as heat and friction.

Wind Turbine	Water Turbine	Power Station - Fossil Fuelled
		
Costs 3.7 p - 5.4 p onshore rising to 5.5 p - 7.2 p/kWh offshore. There are no CO_2 emission costs and a saving of up to 3000 tonnes of CO_2 emission per year in Australia. Can cost £1 million to build a turbine but wind is free!	Costs 6.8 p/kWh but initial building costs are very high. However, the energy from the water is virtually free.	Cost is 2.2 p to 3.2 p but will rise to 5 p/kWh if CO_2 emissions are included. They cannot shut down even in low peak demand.
Wind will always be here but can be unpredictable. Best wind in UK is approximately 25 mph near the coast, so best built near coasts.	Water can be stored so electricity can be generated non-stop. Electricity can be stored in pump storage stations.	Fossil fuels will run out. We have doubled the amount used in 20 years and it's hard to provide fuels, mining is dangerous and so is drilling in rough seas. The power stations need large amounts of fuel so railway lines are built taking up land.
Non-polluting but their size 80 m high and 80 m in diameter can be an eye sore and kill wildlife. They produce a noise.	Non-polluting but take up vast areas of land, drowning forests and wild life. Downstream flow can affect land.	Greenhouse effect producing global warming from waste gases; SO_2 produces acid rain.
Small amounts of electricity produced but can be produced anywhere. The efficiency is only 1.5% but can be increased with blade design - the wind is free.	Large amounts of electricity produced but this depends on the geography of the land for large areas of water and height are needed. At least 26% efficient with water being free.	Large amounts of electricity are produced. The efficiency is 35%, increasing to 70% with combined power stations.
No storage area is needed so only a small land area is required.	Large areas to store the water, such as vast lakes are needed.	Storage is needed either, at the station or at the extraction site.

Unit 11 – The Science of the Universe and Humanity
AO8 – Task 3

Investigating Electrical Energy Production by a Water Turbine

The water turbine will convert the potential energy stored in water at a height into electrical energy.

Energy conversions:

Potential energy of standing water → Kinetic energy of falling water → Kinetic energy of turning blades → Electrical energy produced by generator

Method
1. Measure the area of the turbine's blades.
2. Connect a wind turbine to a multimeter.
3. Drop water over the blades from a height of 1 m.
4. Collect the water and measure how much passes over the blades in a second.
5. Measure the current and voltage produced by the wind turbine on the multimeter.

Calculate the energy of the standing water
Values of standing water:
Height of fall = _______m

Gravity =________ms^{-1}

Mass of water falling per second = ________kg

Potential energy of water = ______J

Calculate the electrical energy produced by the turbine
Electrical measurements:
Current = (A)

Voltage = (V)

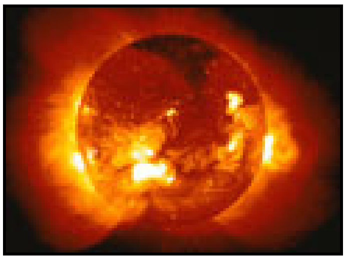
Power (I x V) = (J)

Calculate the efficiency of the turbine converting the water's energy to electricity

Efficiency of the water turbine = $\frac{\text{Electrical power output}}{\text{Potential energy of the falling water}} \times 100$ = ______

Unit 11 – The Science of the Universe and Humanity
AO1

The Solar System contains …

Part of Solar System	Image	Knowledge
Sun	 Image: NASA	Our nearest star is the Sun. Without the Sun we would die as it gives us the energy we need. The Sun is made up of 70% hydrogen gas, 28% helium gas and a 2% mixture of other materials. Due to the large pressure and temperature nuclear fusion takes place as the hydrogen is changed to helium. The energy from this process radiates out across the planets. The Sun formed around 5 million years ago and has used up over half of its initial hydrogen supply. At least 4 million tonnes of matter is used up every second in this reaction but the Sun is so large this process will be able to go on for over 5 million years. The Sun has 333,000 times more mass than the Earth. Its radius of 696,000 km is 109 times that of the Earth. The surface temperature of the Sun is 5,500 °C but its central temperature is 15 billion °C.
Planets	 Image: NASA, ESA	The Solar System consists of the Sun, more than 130 satellites and 8 major planets (Pluto is now classified as a "dwarf planet"). The inner planets are Mercury, Venus, Earth and Mars; the outer planets are Jupiter, Saturn, Uranus and Neptune. The planets orbit the Sun in ellipses which are almost in the same plane. The planets are loose particles of debris left over from the formation of the Sun. In time these particles clumped together to form the planets.

NEPTUNE

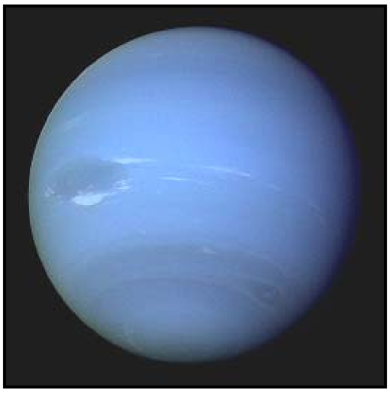


Image: NASA

Neptune, the eighth planet from the Sun, is one of the four 'gas giants' with a diameter 4 times that of Earth and mostly made of water with an atmosphere of hydrogen, helium and methane. It is the methane that gives it its blue colour. It has a white cloud of gas shooting up from its surface every 16 hours forming wispy clouds of methane ice.

Winds blow around the planet at speeds of 600 miles per hour. A circular storm has created a great dark spot which is the size of the Earth and first viewed in 1989, however it hasn't been seen since 1994.

Neptune has at least four faint rings rotating in the same direction in the equatorial plane.

The existence of Neptune was first calculated on paper before it was seen with a powerful microscope. It and cannot be seen with the naked eye as it receives 1000 times less sunlight than the Earth.

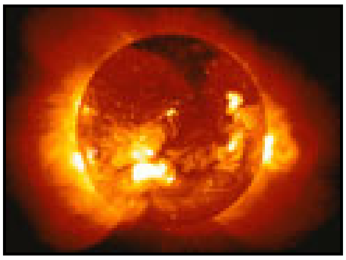
Journey time - 12 Earth years
1 Neptunian year - 164.8 Earth years

FACT CARD

Size	Diameter 49,532 km
Mass	1.024×10^{26} kg
Distance from Sun	4,504 million km
Distance from Earth	4,564 million km, to 4,354 million km
Atmosphere/weather	Hydrogen, helium and methane
Temperature	-220 ºC
Length of year	60,202 Earth days
Length of day	16 Earth hours 7 mins
Moons/satellites	Over 11
Colour	Deep blue
Core	Rocky/ice core

Unit 11 – The Science of the Universe and Humanity
AO1

The Solar System contains …

Part of Solar System	Image	Knowledge
Sun	 Image: NASA	Our nearest star is the Sun. Without the Sun we would die as it gives us the energy we need. The Sun is made up of 70% hydrogen gas, 28% helium gas and a 2% mixture of other materials. Due to the large pressure and temperature nuclear fusion takes place as the hydrogen is changed to helium. The energy from this process radiates out across the planets. The Sun formed around 5 million years ago and has used up over half of its initial hydrogen supply. At least 4 million tonnes of matter is used up every second in this reaction but the Sun is so large this process will be able to go on for over 5 million years. The Sun has 333,000 times more mass than the Earth. Its radius of 696,000 km is 109 times that of the Earth. The surface temperature of the Sun is 5,500 °C but its central temperature is 15 billion °C.
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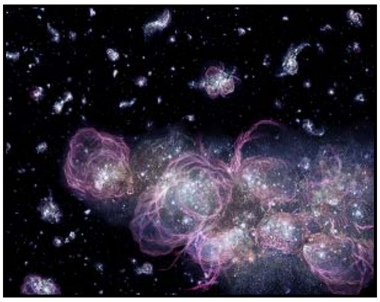
Unit 11 – The Science of the Universe and Humanity
AO1

The Life of a Sun

Life of a Sun	
Nebula 	Gravity at the centre of a large cloud of gas and dust pulls it inward into a huge gas ball which gets smaller and denser.
Protostar 	This dense ball of gas and dust may be 1.5 trillion km in diameter. Under huge pressure it shrinks rapidly over 1000 years to a diameter of 80 million km. With the atoms in the ball being pulled closer and faster together the friction between them, as they rub against each other increases the temperature, giving off a glow 100 times greater than the Sun. As the temperature reaches millions of degrees nuclear fusion starts at the centre.
Star 	As the protostar shines brightly the heat blows away the remaining gas and dust, which may itself develop into a star. Our star, the Sun, is a small yellow. The Sun could shine steadily for perhaps 10,000 million years but then its source of energy will run out.

Unit 11 – The Science of the Universe and Humanity

AO1 – Task 2

The Evolution of our Sun

Life of the Sun	
Nebula	
Protostar	
Star	
Red Giant	
White Dwarf	
Black Dwarf	

The Kingshurst Basic Route for OCR Level 2 National in Science

USB Key Costings

Units 1, 2, and 11	£300.00
Units 3 and 4	£200.00
Unit 7	£100.00
Unit 8	£100.00
Unit 9	£100.00
Unit 10	£100.00

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