**About the Universe**

The **Universe** is everything that exists, including the things we cannot see and do not yet know about. It is hard to imagine just how enormous the Universe is, because it seems to have no beginning and no end...

Many scientists think the Universe grew out of an explosion – known as the **Big Bang** – that happened billions of years ago. They say that the explosion threw out hot materials which later formed all the galaxies, stars, moons and planets in the space.

Soon after the Big Bang, when the Universe first began, all the things inside it were closer together – but as time has passed, these elements spread further and further apart. People have tried to guess the size of the Universe, but nobody knows exactly how big it really is. However, astronomers have seen that the galaxies inside it are slowly moving away from each other. This must mean that the Universe is getting bigger all the time.

**Staring into space**

Staring into **space** is something people do all the time. On a clear night, we are able to see bright objects in the sky. Things in space look like tiny dots to us, because they are so far away, but most are actually extremely large. We live on a planet, and most of the bright dots in our sky are stars. The nearest one is the **Sun**. It looks enormous because it is so much closer to us than any other stars.

After the Sun has gone down, the **Moon** is the brightest thing in the sky. The Moon is the closest object to us in space, much closer than the Sun. Although it looks quite big in our sky, it is many times smaller than the Sun.

**It's quiet up here...**

When something makes a sound, the noise spreads into the air around our ears. Our world is full of air, which is why we can hear a lot of sounds – but there is no air in the space. That is the reason we could hear nothing in space.

**Why is it so dark in space?**

Light travels through space with the speed of 300 000 kilometres per second. Day and night, all the light we receive comes from the stars. We can only see light when it hits an object and bounces off it. Our planet, **Earth**, is bright because light can bounce off tiny specks, called 'particles', in the atmosphere around it . Up in the space there are gigantic areas of nothingness, so there are no particles for the light to hit.

**Secrets of the stars**

Stars are the true giants of space. They are the most common objects in the night sky, but in many ways the most complicated. Astronomers have spent years solving the mystery of how stars 'live' and 'die'.

**A star is born**

Stars are made in swirling clouds called **nebulas**. Nebulas are made of gas and dust which bind together, pulled by **gravity**, to form gigantic, spinning balls. As the mass falls together it gets hot.

A star is formed when it is hot enough for the **hydrogen nuclei** to **fuse together to make helium**. This nuclear fusion process releases **energy**, which keeps the core of the star hot. These young stars shine, making the nebula glow in beautiful colours.

During this **stable phase** in the life of the star, the force of gravity holding the star together is balanced by the high pressures caused by the high temperatures. **Our Sun is at this stable phase** in its life.

**Stars change** when they grow older, and eventually they die – but only after billions of years.

Stars die when they run out of fuel. When all the hydrogen has been used up in the fusion process, larger nuclei begin to form and the star may expand to become a **red giant** or explode as a **supernova**. Smaller and middle-sized stars, like our Sun, die very gently and quietly. They swell up to become huge **'red giants'** and then , when all the nuclear reactions are over, slowly cool and shrink as layers of gas are pushed away into space. They become **white dwarfs,** that fade and change colours as they cool down.

The biggest stars, called **supergiants**, live for the shortest time. When supergiants run out of fuel they get hotter and expand until they collapse in the middle, sending their outside layers into space with a gigantic, dazzling bright explosion. This is called a **supernova.**

When a supergiant star ends its life in a supernova, the left-over bits and pieces usually form something called a **neutron star**, which shrinks, pulled in by its own gravity. Some of the matter in the supernova is thrown off into space as dust and gas. Some of this dust and gas will go on to make new stars. Our Sun contains **heavy elements**, which suggests that it was probably created from the dust of an old supernova, along with the rest of the **solar system**, including our own bodies! We are really 'star dust'.

But sometimes, gravity pulls so hard on the left-overs that they cannot escape and are all squash together and shrink into a single point in space. The core of the former supernova becomes a **black hole**.

**TASKS PART 1**

1. Draw a chart/ picture/ small poster to show the possible life cycle of a star. Describe briefly. ( max 30p.)
2. What is the likely end to our star, the Sun? (max 10p.)
3. Why do people say that when you look at the stars you are looking back through history? (max 10p.)
4. Light from the Sun takes a little over eight minutes to reach us. Light travels at 300 000 km/s. How far away is the Sun? Show your working! (max 10p.)

To work out the speed of a moving object you need two measurements –
the **distance** the object travels and the **time** it takes to move that distance.
If an object moves in a straight line with a constant speed it can be calculated by dividing the distance by the time taken. This is shown in this formula:

$$\boldsymbol{speed = \frac{distance\ travelled}{time\ taken}}$$

The unit of speed is the metre per second (m/s)

$$\boldsymbol{speed\ (m/s)\ = \frac{distance\ travelled\ (m)}{time\ taken\ (s)}}$$

*Example :*
An alien on a bicycle travels 300 m in one minute. What is his average speed?

distance, S = 300 m
time, t = 1min = 60 s

$V = \frac{S}{t}$ $V = \frac{300m}{60s} = 5\ m/s$

*Answer*:
The alien's average speed is 5 m/s.

**Vocabulary**

air – powietrze
although – chociaż
averge – przeciętna
billion – miliard
collapse – zapaść się, zawalić
common – zwyczajny, pospolity
distance - odległość, droga
dust – pył
dwarf – krasnal, karzeł
enormous – ogromny
fuel – paliwo
fusion – połączenie
galaxy – galaktyka
gravity – grawitacja
guess – zgadywać
heavy elements – pierwiastki ciężkie
helium – hel
hole – dziura
hydrogen – wodór
layer – warstwa
left-overs – resztki
matter – materia
nothingness – nicość
nucleus – jądro
reason – powód
receive – otrzymać, uzyskać
run out (of) – zużyć się, wyczerpywać
show your working – zaprezentuj tok rozumowania
shrink – zmniejszać
space – przestrzeń
speed – prędkość
spread – rozprzestrzeniać
stable phase – faza stabilności
swirl ing – wirujące
throw out – wyrzucać