SPACE

AQA GCSE Physics | Topic 8

STUDENT EDITION

Contents

Name: ______________________________ Teacher: ______________________________

Space Facts Quiz

Cover the answer column and test your recall. Use these for quick retrieval practice.

#	Question	Answer
1	How many planets are there in our solar system?	
2	Write the planets in the solar system in order.	
3	What is a satellite? What are the two types of satellite?	
4	What galaxy is the solar system a part of?	
5	What is a nebula?	
6	How is a star formed?	
7	Once a star is formed, how does it reach equilibrium?	
8	What are the stages in the life cycle of a star of similar size to the Sun?	
9	What are the stages in the life cycle of a star much more massive than the Sun?	
10	How are elements heavier than iron produced?	
11	What provides the force that allows planets and satellites to maintain their circular orbits?	
12	How can the force of gravity lead to changing velocity but unchanged speed?	
13	What happens to the radius of an orbit if the speed increases?	
14	What evidence do we have for the Big Bang?	
15	What does the red shift tell us about the universe?	
16	What happens to the wavelength of a wave if the source is moving towards us?	
17	What have observations of recent supernovae suggested?	

LESSON 1

Our Solar System

Do Now

1. Name as many planets in our Solar System as you can.
2. Name the force that causes objects to fall to the ground.
3. Name three different forces.
4. What is the difference between **mass** and **weight**?

Part 1 of 3 | The Sun and the Planets

Key Information

Our **Solar System** is made of one star (the **Sun**) and eight planets that orbit around it. 1

The eight planets, in order from the Sun: **Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune**. 2

A useful mnemonic: *My Very Easy Method Just Speeds Up Naming Planets*. 3

The first four planets (Mercury, Venus, Earth, Mars) are **terrestrial planets** — small, rocky. 4

Jupiter, Saturn, Uranus, Neptune are **gas giants** (Uranus and Neptune are sometimes called ice giants). 5

Pluto is now classified as a **dwarf planet**, not a planet, because it has not cleared its orbit of other objects. 6

Other objects in the solar system include moons, comets, asteroids and dwarf planets. 7

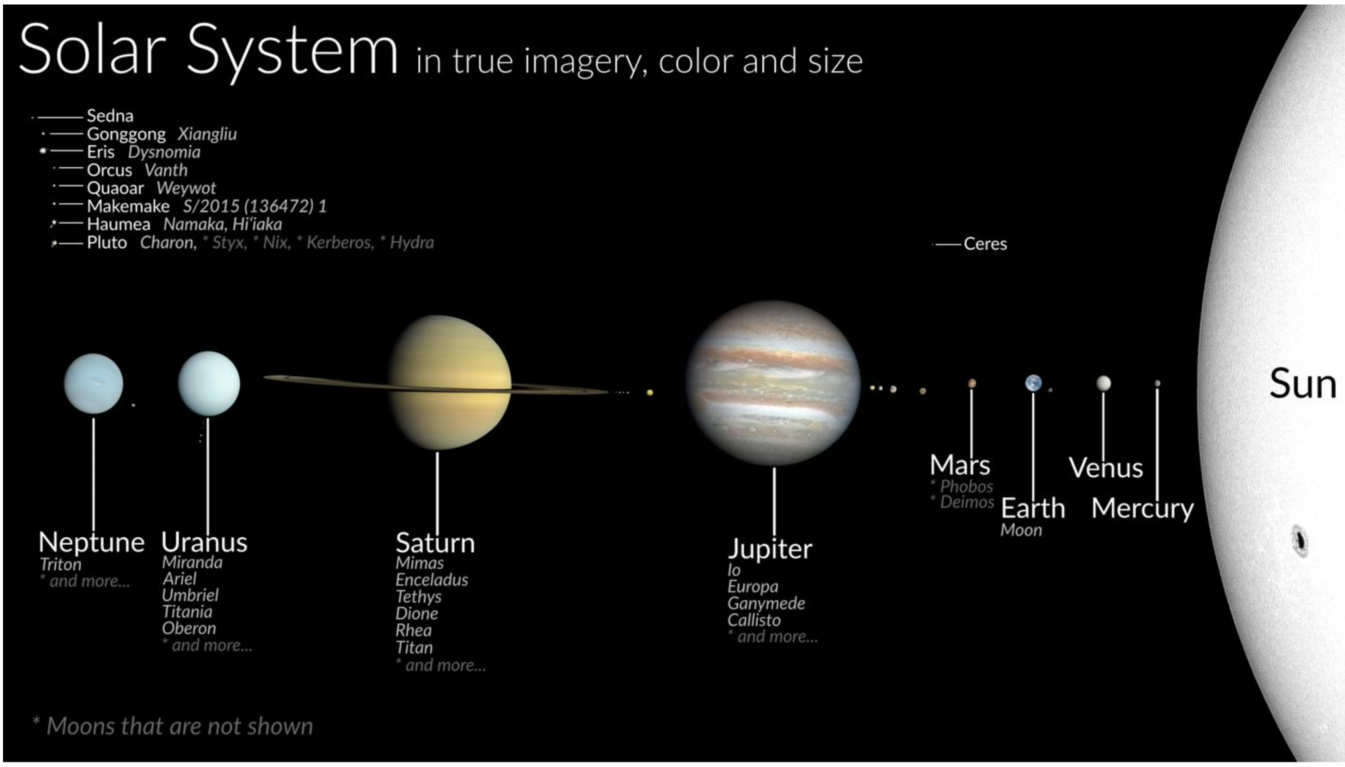

Fig 1.1 — The eight planets of the Solar System in true colour and size

Questions

1. Name the star at the centre of our Solar System.

(1 mark)

2. List the eight planets of the Solar System in order, starting from the Sun.

(4 marks)

3. State which type of object Pluto is now classified as. Explain why it is not classed as a planet.

(2 marks)

4. Name two terrestrial planets and two gas giants.

(2 marks)

5. Other than planets, name three other types of object that orbit the Sun.

(3 marks)

Part 2 of 3 | Galaxies and the Universe

Key Information

A **galaxy** is a huge collection of billions of stars, held together by gravity.	1
Our Solar System is part of the **Milky Way** galaxy.	2
There are billions of galaxies in the observable **Universe**.	3
A **star** is a giant ball of plasma (mostly hydrogen and helium) that emits light and heat from **nuclear fusion**.	4
Stars are very far away — distances are often measured in **light-years** (the distance light travels in one year).	5
The order of size, smallest to largest: planet < star < solar system < galaxy < Universe.	6

Fig 1.2 — A nebula: a cloud of dust and gas from which stars form

Fig 1.3 — Our Sun, a main sequence star

Questions

6. State which galaxy our Solar System belongs to.

(1 mark)

7. Define what is meant by a **galaxy**.

(2 marks)

8. Explain the difference between a **star** and a **planet**.

(2 marks)

9. Place these in order of size, smallest first: galaxy, planet, Universe, star, solar system.

(2 marks)

10. State **one** reason why distances in space are usually measured in light-years rather than kilometres.

(1 mark)

Part 3 of 3 | Exam-Style Questions

EXAM QUESTION — Q1: Our Solar System (8 marks)

Mark allocations shown as (n) following AQA convention.

(a) There are eight planets in orbit around the Sun. Which other type of object also orbits the Sun? Tick **one** box: Dwarf planet □ Galaxy □ Moon □ Star □

(1)

(b) Complete the sentences. Choose the answers from the box: *hydrogen, dwarf planets, Milky Way, nebula, fusion, friction*.
There are eight planets in orbit around the Sun, along with some ________________ like Pluto. The Solar System is part of the galaxy which is called the ________________.

(2)

(c) Name the galaxy our Solar System belongs to and state approximately how many stars it contains.

(2)

(d) Distances between stars are measured in light-years. Define what is meant by a **light-year**.

(1)

(e) State **two** ways in which a star differs from a planet.

(2)

LESSON 2

Star Formation

Do Now

1. Which galaxy is our Solar System part of?
2. What force pulls dust and gas together in space?
3. Name the lightest element in the Universe.
4. Roughly what temperature does the centre of the Sun reach? (Order of magnitude.)

Part 1 of 3 | Nebulae and Protostars

Key Information

A **nebula** is a cloud of dust and gas in space, mostly **hydrogen** and helium. 1

Gravity pulls the gas and dust in a nebula closer together. 2

As the particles collide more frequently, **friction** heats up the gas. 3

When enough mass has gathered together, the cloud becomes a **protostar**. 4

A protostar continues to contract and heat up until the core temperature reaches over **10 million °C**. 5

At this temperature, **nuclear fusion** can begin and a **main sequence star** is born. 6

Questions

1. Define what is meant by a **nebula**.

(2 marks)

2. State the force that pulls the dust and gas in a nebula together.

(1 mark)

3. Explain how friction in a nebula causes its temperature to rise.

(2 marks)

4. Define what is meant by a **protostar**.

(1 mark)

5. State the approximate temperature required at the core of a protostar for nuclear fusion to begin.

(1 mark)

Part 2 of 3 | Nuclear Fusion

Key Information

Nuclear fusion is the joining of two small (light) atomic nuclei to form a heavier nucleus. 1

Fusion releases a huge amount of energy, which keeps the star hot and shining. 2

In a star like the Sun, fusion combines isotopes of **hydrogen** to form **helium**. 3

Mass is converted into energy ($E = mc^2$): a tiny loss of mass produces enormous energy because *c* is so large. 4

Once fusion starts, the energy released maintains the high temperature, and fusion continues until the fuel runs out. 5

A star in this stable, fusion-powered phase is called a **main sequence star**. Our Sun is currently a main sequence star. 6

$$^{2}_{1}\mathrm{H} + ^{1}_{1}\mathrm{H} \rightarrow ^{3}_{2}\mathrm{He} + \text{energy}$$

Questions

6. Define **nuclear fusion**.

(2 marks)

7. State which two elements are mainly involved in fusion in the Sun.

(2 marks)

8. Explain why nuclear fusion releases so much energy.

(2 marks)

9. Name the stage of a star's life cycle in which it is steadily fusing hydrogen into helium.

(1 mark)

10. State **one** reason why a star remains stable during the main sequence phase.

(2 marks)

Part 3 of 3 | Exam-Style Questions

EXAM QUESTION — Q2: Star Formation (7 marks)

Mark allocations shown as (n) following AQA convention.

(a) Use the correct answer from the box to complete the sentence. *black hole gravity friction nebula protostar upthrust*
The Sun was formed when a ________________ in space was pulled together by ________________.

(2)

(b) Describe how a protostar becomes a main sequence star.

(3)

(c) State the name of the process by which energy is released in stars.

(1)

(d) Explain why a main sequence star is described as **stable**.

(1)

LESSON 3

Life Cycle of a Sun-like Star

Do Now

1. How is a protostar formed from a nebula?
2. What temperature must be reached for nuclear fusion to begin?
3. Name the two elements involved in fusion in the Sun.
4. What stage in its life cycle is the Sun in **now**?

Part 1 of 3 | Stable Equilibrium

Key Information

While a star is on the main sequence, it is in a **stable equilibrium**: the inward force of gravity is balanced by the outward force from radiation produced by nuclear fusion. 1

If gravity were larger, the star would collapse; if radiation pressure were larger, it would expand. 2

The Sun has been a main sequence star for about 4.6 billion years. 3

The Sun is expected to remain a main sequence star for about another 5 billion years. 4

While stable, the star's size, brightness and surface temperature stay roughly constant. 5

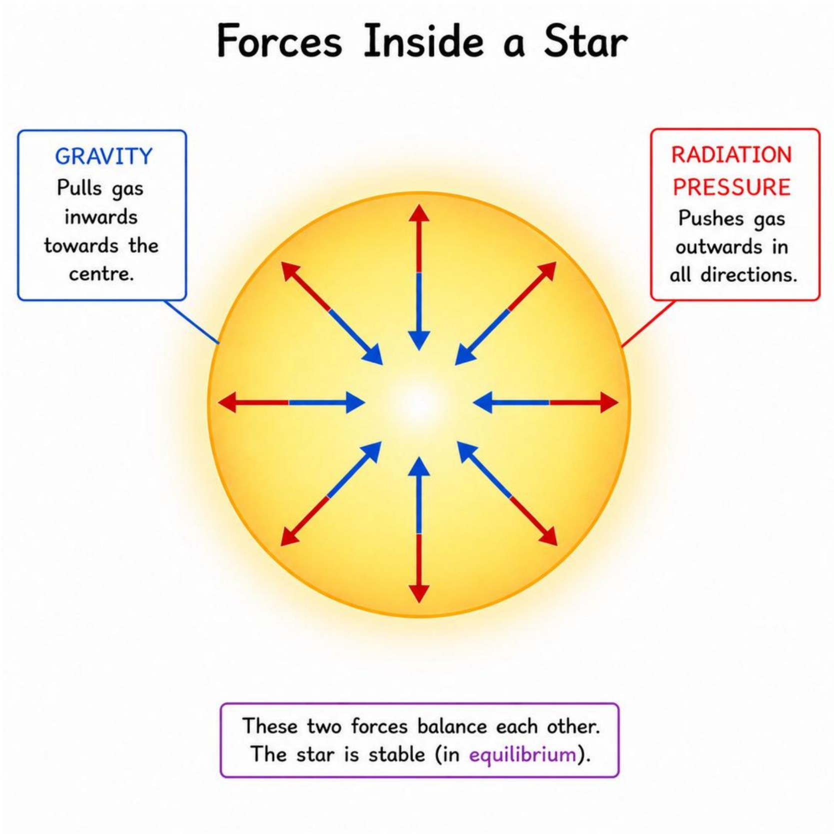

Fig 3.1 — Balanced forces inside a stable main sequence star

Questions

1. Name the **two** forces that are balanced in a stable main sequence star.

(2 marks)

2. State the direction in which each of those two forces acts.

(2 marks)

3. Explain what would happen to a star if the inward force were greater than the outward force.

(2 marks)

4. Approximately how long has the Sun been a main sequence star, and how much longer is it expected to remain one?

(2 marks)

Part 2 of 3 | After the Main Sequence

Key Information

When the hydrogen in the core runs out, the force from fusion decreases and the star contracts under gravity.	1
The contraction increases the core temperature until **helium** can fuse into heavier elements.	2
This new fusion releases more radiation, and the outer layers expand and cool: the star becomes a **red giant**.	3
After helium runs out, the outer layers drift away as a **planetary nebula**.	4
What remains at the centre is a small, hot, dense core called a **white dwarf**.	5
Over a very long time, the white dwarf cools and stops emitting light, becoming a **black dwarf**.	6
Life cycle (Sun-like): nebula → protostar → main sequence → red giant → white dwarf → black dwarf.	7

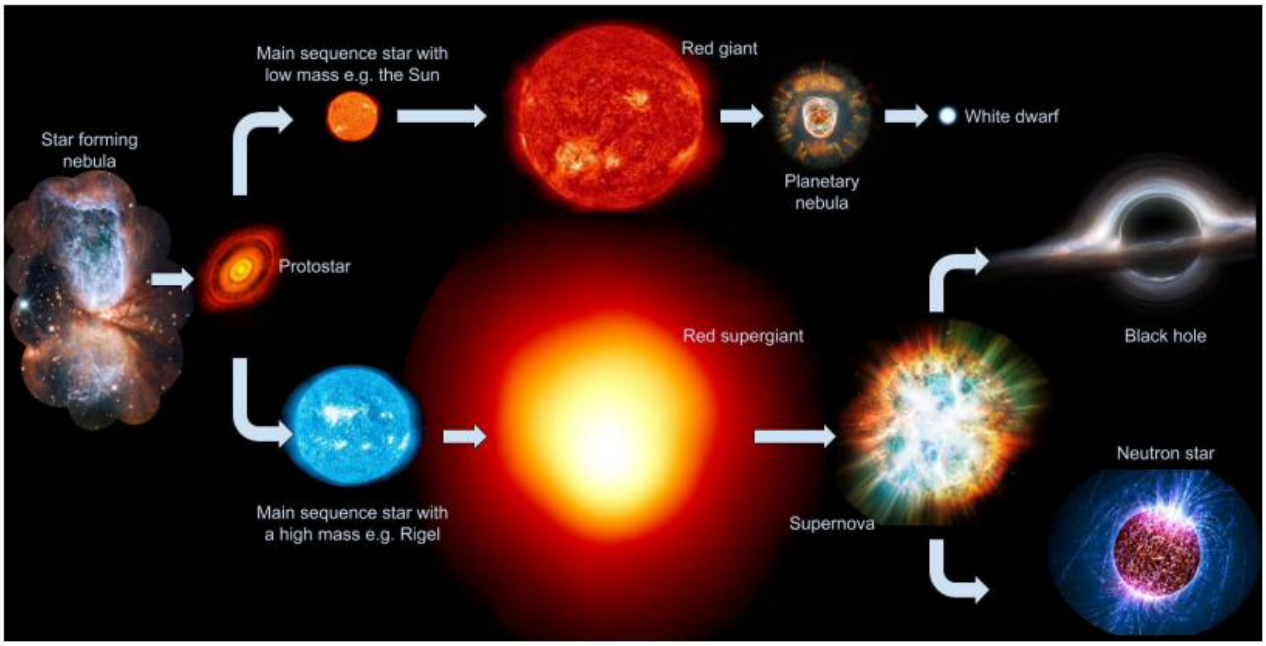

Fig 3.2 — The life cycle of stars of different masses

Questions

5. Describe what happens when the hydrogen in the core of a Sun-like star runs out.

(2 marks)

6. State why the star expands to become a red giant.

(2 marks)

7. Name the stage in which the outer layers of a Sun-like star drift away into space.

(1 mark)

8. State the name of the small, hot, dense remnant left behind after a Sun-like star sheds its outer layers.

(1 mark)

9. List the stages of the life cycle of a Sun-like star, in order, starting from **nebula**.

(4 marks)

Part 3 of 3 | Exam-Style Questions

EXAM QUESTION — Q3: Life Cycle of a Sun-like Star (8 marks)

Mark allocations shown as (n) following AQA convention.

(a) State why a star is stable during the main sequence period of its life cycle.

(2)

(b) The life cycle of a star after the main sequence depends on its mass. A particular star is the same size as the Sun. State the stages, in order, after the main sequence in the life cycle of this star.

(3)

(c) Use the correct answer from the box to complete the sentence. *decay* *fission* *fusion*
Energy is released in stars by the process of nuclear ________________.

(1)

(d) State the name of the cloud of gas and dust expelled by a Sun-like star late in its life.

(1)

(e) Explain why a white dwarf eventually becomes a black dwarf.

(1)

LESSON 4

Massive Stars and the Origin of the Elements

Do Now

1. What is the final stage of a Sun-like star's life cycle?
2. Name the force that acts inwards in a stable star.
3. Name the process that produces the outward force in a stable star.
4. Name **two** elements lighter than iron and **one** element heavier than iron.

Part 1 of 3 | Red Supergiants and Supernovae

Key Information

A star much more massive than the Sun follows a different path after the main sequence. 1

It expands into a **red supergiant** rather than a red giant. 2

Inside a red supergiant, fusion creates progressively heavier elements: helium, carbon, oxygen, …, up to **iron**. 3

Iron is the heaviest element that can be produced by fusion in a star's core, because fusing iron **absorbs** energy rather than releasing it. 4

When fusion stops, gravity is no longer balanced and the core collapses. 5

The collapse causes a massive explosion called a **supernova**. 6

The supernova produces and ejects elements **heavier than iron** (e.g. gold, lead, uranium) throughout the Universe. 7

Questions

1. Name the type of star formed when a star much more massive than the Sun expands.

(1 mark)

2. State the name given to the explosion at the end of a massive star's life.

(1 mark)

3. Explain why iron is the heaviest element that can be made by fusion in a star's core.

(2 marks)

4. Describe how elements heavier than iron, such as gold, are formed.

(2 marks)

5. State why the heavy elements in your body could only have come from a supernova.

(2 marks)

Part 2 of 3 | Neutron Stars and Black Holes

Key Information

What remains after a supernova depends on the mass of the original star. 1

If the original star was massive, a small, very dense object called a **neutron star** is left behind. 2

If the original star was extremely massive, the core collapses to a single point and a **black hole** is formed. 3

A black hole has a gravitational field so strong that not even light can escape from it. 4

Life cycle (massive): nebula → protostar → main sequence → red supergiant → supernova → neutron star or black hole. 5

Questions

6. State **two** things that can be left after a supernova.

(2 marks)

7. State which of these is formed from the most massive stars.

(1 mark)

8. Define what is meant by a **black hole**.

(2 marks)

9. List the stages of the life cycle of a very massive star, in order, starting from nebula.

(4 marks)

10. Compare the life cycle of a massive star with that of a Sun-like star — identify **one** similarity and **one** difference.

(2 marks)

Part 3 of 3 | Exam-Style Questions

EXAM QUESTION — Q4: Massive Stars and Heavy Elements (7 marks)

Mark allocations shown as (n) following AQA convention.

(a) Use the correct answer from the box to complete the sentence. *hydrogen* *iron* *uranium*
The early Universe contained only ________________.

(1)

(b) Use the correct answer from the box to complete the sentence. *main sequence star* *protostar* *supernova*
The heaviest elements are formed only in a ________________.

(1)

(c) Use the correct answer from the box to complete the sentence. *red giant* *red supergiant* *white dwarf*
Only a star much bigger than the Sun can become a ________________.

(1)

(d) The Universe now contains a large variety of different elements. Describe how this happened.

(4)

LESSON 5

Orbits, Gravity and Circular Motion

Do Now

1. Define **gravity**.
2. What is the difference between a **scalar** and a **vector**?
3. State whether **speed** is a scalar or a vector. Repeat for **velocity**.
4. Name **one** natural object that orbits the Earth.

Part 1 of 3 | Centripetal Force and Gravity

Key Information

An object moving in a **circular orbit** is constantly changing direction.	1
Because direction is changing, the **velocity** is changing, even if the speed is constant.	2
A change in velocity means the object is **accelerating**, which requires a **resultant force**.	3
For a planet, moon or satellite, this resultant force is the force of **gravity**.	4
This inward force, towards the centre of the orbit, is called the **centripetal force**.	5
Without gravity, the orbiting object would travel in a straight line (Newton’s First Law).	6

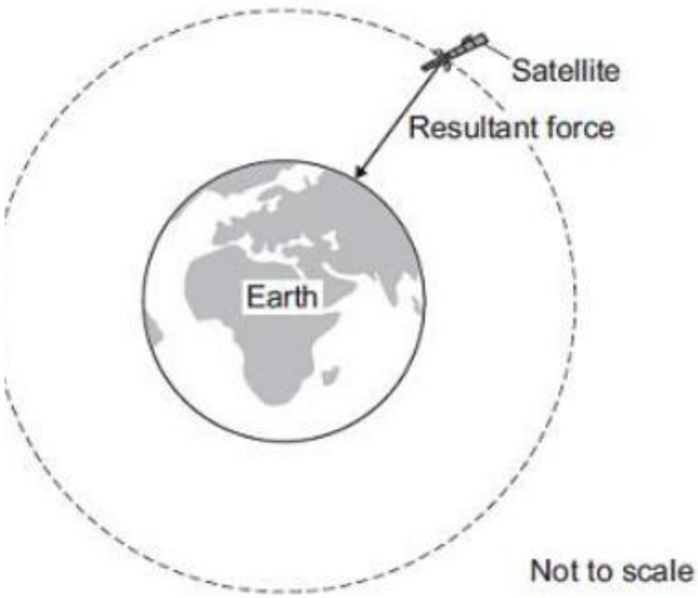

Fig 5.1 — Gravity provides the centripetal force on an orbiting satellite

Questions

1. State the name of the force that keeps planets in orbit around the Sun.

(1 mark)

2. Define **centripetal force**.

(2 marks)

3. Explain why an object moving in a circle at constant speed is still accelerating.

(2 marks)

4. State the direction in which the centripetal force acts on an orbiting satellite.

(1 mark)

5. State **two** factors that determine the size of the gravitational force on a satellite orbiting Earth.

(2 marks)

Part 2 of 3 | Speed, Velocity and the Orbit Radius

Key Information

In a stable circular orbit, an object travels at a constant **speed**. 1

Its **velocity** is not constant, because direction is constantly changing. 2

An orbit closer to a planet (smaller radius) requires a higher orbital speed. 3

An orbit further from a planet (larger radius) has a lower orbital speed and a longer orbital time. 4

If a satellite is moved to a faster orbit, the radius decreases; if it is slowed, the radius increases. 5

Orbital speed: $v = (2\pi r) / T$, where r = orbital radius (m) and T = time for one orbit (s). 6

$$v = \frac{2\pi r}{T}$$

Questions

6. Explain why a satellite in a circular orbit has a changing velocity but a constant speed.

(2 marks)

7. State what happens to the orbital speed if the orbit radius decreases.

(1 mark)

8. Calculate the orbital speed of a satellite that orbits at a radius of 7 000 km in 92 minutes. (Convert km to m and minutes to s.) Give your answer in m/s.

(3 marks)

9. The Moon orbits Earth at a radius of 384 000 km, taking 28 days. Calculate the speed of the Moon, in m/s. (1 day = 86 400 s.)

(3 marks)

10. Light from the Sun takes 3 minutes to reach Mercury and 8 minutes to reach Earth. Mercury orbits the Sun in 3 months and Jupiter in about 11 years. Which of Mercury and Jupiter is travelling faster? Justify your answer.

(3 marks)

Part 3 of 3 | Exam-Style Questions

EXAM QUESTION — Q5: Orbital Motion (7 marks)

Mark allocations shown as (n) following AQA convention.

(a) Man-made satellites orbit the Earth. The satellite experiences a resultant force directed towards the centre of the orbit. State the name given to this resultant force.

(1)

(b) State what provides the centripetal force on the satellite.

(1)

(c) State **two** factors that determine the size of the centripetal force on the satellite.

(2)

(d) When in stable orbit, a satellite travels at a constant speed but its velocity is constantly changing. Explain why.

(3)

LESSON 6

Satellites

Do Now

1. What force keeps a satellite in orbit?
2. Name **one** natural satellite of the Earth.
3. What does it mean to be “in orbit” around a planet?
4. For a satellite in circular orbit at constant speed, what changes? What stays the same?

Part 1 of 3 | Natural and Artificial Satellites

Key Information

A **satellite** is an object in orbit around a planet (or another body). 1

A **natural satellite** is one that occurs in nature, such as the Moon orbiting the Earth. 2

An **artificial satellite** is one launched by humans, e.g. for communications, weather, GPS or science. 3

Artificial satellites generally fall into two main categories: **geostationary** and **low orbit (monitoring)**. 4

Geostationary satellites orbit the Earth once every **24 hours**, staying above the same point above the equator. They are used mainly for **communications** (TV, phone). 5

Low orbit / monitoring satellites orbit much closer to Earth and take only 90 min – 3 hours per orbit. They are used for weather monitoring, mapping and Earth observation. 6

The first artificial satellite, **Sputnik 1**, was launched in 1957. 7

Two main types of artificial satellite:

Geostationary — ~36 000 km above Earth, 24-hour orbital period, stays fixed above the equator. Used for TV, phone, internet.

Low Earth Orbit (LEO) — 200–2 000 km, ~90-minute period. Used for weather monitoring, GPS, Earth observation.

Fig 6.1 — An artificial satellite orbiting the Earth

Questions

1. Define what is meant by a **satellite**.

(1 mark)

2. State the difference between a **natural** and an **artificial** satellite. Give one example of each.

(4 marks)

3. Name the two main types of artificial satellite that orbit the Earth.

(2 marks)

4. State the time taken for a geostationary satellite to complete one orbit and give one common use for it.

(2 marks)

5. State **one** reason why a weather (monitoring) satellite is placed in a low orbit.

(1 mark)

Part 2 of 3 | Calculating Orbital Speed and Period

Key Information

Distance travelled in one orbit = circumference of the orbit = $\mathbf{2\pi r}$. 1

r is the radius from the **centre** of the planet, not the height above the surface. 2

Speed of an orbiting satellite: $v = 2\pi r / T$, where T is the orbital period in seconds. 3

Closer satellites have higher speed and shorter period; further satellites have lower speed and longer period. 4

Mass of the satellite does **not** affect orbital speed at a given radius. 5

$$v = \frac{2\pi r}{T}$$

$$r = r_{Earth} + \text{height above surface}$$

Questions

6. A satellite orbits at an average distance from the centre of the Earth of 6 700 km, taking 92 minutes. Calculate its speed in m/s.

(3 marks)

7. A geostationary satellite orbits 36 000 km above the Earth's surface. The radius of the Earth is 6 371 km. Calculate the radius of the orbit.

(1 mark)

8. Use your answer from Q2 (and T = 24 hours) to calculate the orbital speed of the geostationary satellite, in m/s.

(3 marks)

9. State **one** factor that does **not** affect the orbital speed of a satellite at a given radius.

(1 mark)

10. State the relationship between orbit height and orbital period (time to complete one orbit).

(1 mark)

Part 3 of 3 | Exam-Style Questions

EXAM QUESTION — Q6: Satellites (8 marks)

Mark allocations shown as (n) following AQA convention.

(a) Describe the orbit of an artificial satellite around the Earth.

(1)

(b) State what provides the force needed to keep a satellite in its orbit.

(1)

(c) The table below gives data for five satellites orbiting the Earth. Satellite A: 370 km, 93 min. Satellite B: 697 km, 99 min. Satellite C: 827 km, 103 min. Satellite D: 5 900 km, 228 min. Satellite E: 35 800 km, 1440 min. State the relationship between the height of the satellite above the Earth's surface and the time taken for it to orbit the Earth once.

(1)

(d) Using the data in (c), state the relationship (if any) between the orbital period and the mass of the satellite. Justify your answer.

(2)

(e) A satellite is moved to a lower orbit. Describe and explain what happens to its orbital speed and orbital period.

(3)

LESSON 7

Red-shift and the Big Bang

Do Now

1. Define **wavelength**.
2. Write down the colours of the visible spectrum, from longest to shortest wavelength.
3. Write the planets in the Solar System in order.
4. What is a **satellite**? What are the two types of satellite?
5. What galaxy is the Solar System a part of?
6. What is a **nebula**?

Part 1 of 3 | The Doppler Effect and Red-shift

Key Information

The **Doppler effect** is the change in wavelength (and frequency) of a wave when the source is moving relative to the observer. 1

If the source is moving **towards** us: wavelength decreases, frequency increases (e.g. siren sounds higher pitched). 2

If the source is moving **away** from us: wavelength increases, frequency decreases (e.g. siren sounds lower pitched). 3

The same effect happens with light: if a galaxy is moving away from us, its light is shifted to longer (redder) wavelengths — this is **red-shift**. 4

If a galaxy is moving towards us, its light is shifted to shorter (bluer) wavelengths — this is **blue-shift**. 5

Red-shift is observed in the absorption lines (dark lines) in the spectrum of light from distant galaxies. 6

The greater the red-shift, the faster the galaxy is moving away. 7

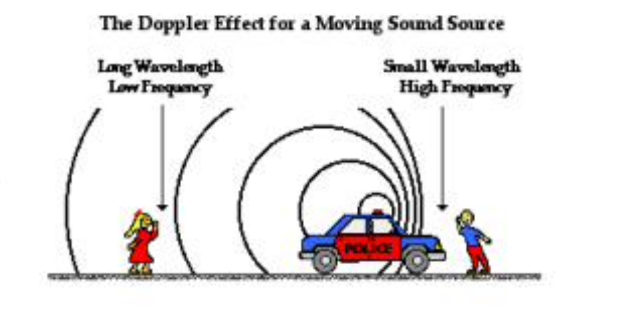

Fig 7.1 — Doppler effect: a moving source shifts wave frequency

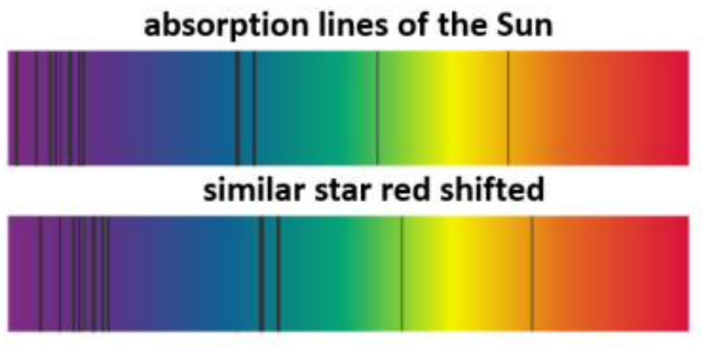

Fig 7.2 — Absorption lines shifted to the red for a receding galaxy

Questions

1. Define the **Doppler effect**.

(2 marks)

2. State what happens to the wavelength of light if a galaxy is moving towards Earth.

(1 mark)

3. State what is meant by **red-shift**.

(2 marks)

4. Galaxy X has a larger red-shift than galaxy Y. State which galaxy is moving away from Earth faster, and which is closer to Earth.

(2 marks)

5. Explain why scientists look at the dark absorption lines in a galaxy's spectrum, rather than just its overall colour, to detect red-shift.

(2 marks)

Part 2 of 3 | The Big Bang and Evidence

Key Information

Almost all distant galaxies show **red-shift**: they are moving away from us. 1

The further away a galaxy is, the greater its red-shift — so the faster it is moving away. 2

This is evidence that the **Universe is expanding**. 3

Working backwards in time, the Universe must once have been very small, hot and dense. 4

The **Big Bang theory** states that the Universe began about 13.8 billion years ago from a single, very small, very hot, very dense region. 5

Two main pieces of evidence: (1) red-shift of distant galaxies; (2) **cosmic microwave background radiation (CMBR)** — faint microwave radiation coming from all directions, predicted by the Big Bang theory. 6

Recent observations of distant **supernovae** show that the most distant galaxies are receding even **faster** than expected — the expansion of the Universe is **accelerating**. Scientists are still trying to explain this ("dark energy"). 7

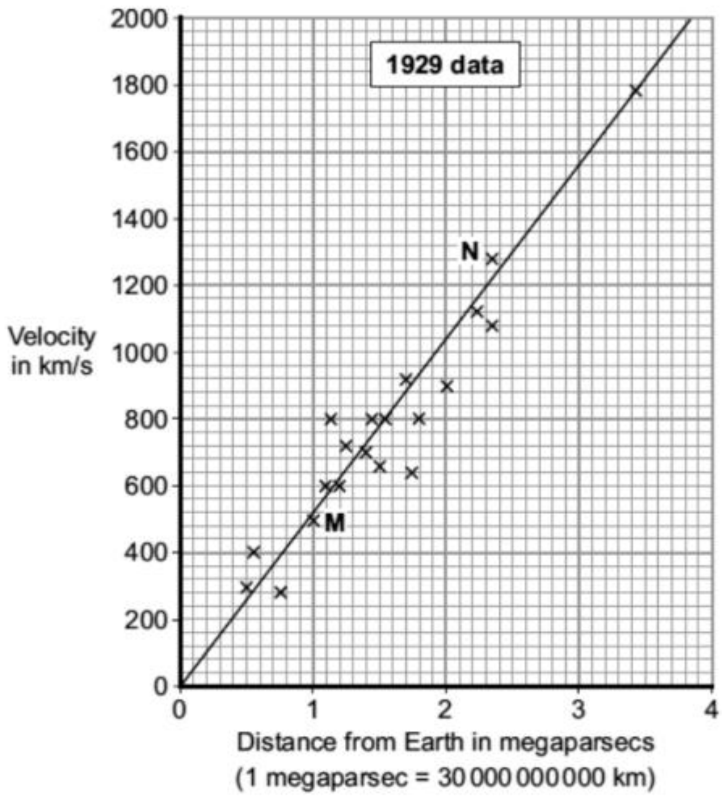

Fig 7.3 — Hubble's 1929 data: galaxy recession velocity vs distance — evidence the Universe is expanding

Questions

6. State **two** pieces of evidence that support the Big Bang theory.

(2 marks)

7. Describe what the Big Bang theory states.

(3 marks)

8. Explain how red-shift gives evidence that the Universe is expanding.

(3 marks)

9. State what observations of distant supernovae have suggested about the expansion of the Universe.

(1 mark)

10. Suggest **one** reason why scientists currently accept the Big Bang theory rather than other explanations.

(1 mark)

Part 3 of 3 | Exam-Style Questions

EXAM QUESTION — Q7: Red-shift and the Big Bang (9 marks)

Mark allocations shown as (n) following AQA convention.

(a) Compared to the light from the Sun, the light from a distant galaxy has moved towards the red end of the spectrum. State the name given to this effect.

(1)

(b) Complete the sentence by choosing the correct ending. *The fact that light from a distant galaxy seems to move towards the red end of the spectrum gives scientists evidence that … (galaxies are shrinking / galaxies are changing colour / the Universe is expanding)*

(1)

(c) Scientists have a theory that the Universe began from a very small point and then expanded outwards. State the name given to this theory.

(1)

(d) Which statement gives a reason why scientists think that the Universe began with an explosion? Tick **one**: At the moment it is the best way of explaining our scientific knowledge ☐ It can be proved using equations ☐ People felt the explosion ☐

(1)

(e) Light from a distant galaxy seems to move towards the red end of the spectrum. Compared to a light wave from the Sun, state how the wavelength and frequency have changed.

(2)

(f) Star B has a smaller red-shift than star D. State which star is moving away faster.

(1)

(g) State **one** piece of evidence, other than red-shift, that supports the Big Bang theory.

(1)

(h) State what observations of distant supernovae suggest about the rate at which the Universe is expanding.

(1)