6. Space physics

6.2 Stars and the Universe

Paper 1 and 2

Question Paper

Paper 1

Questions are applicable for both core and extended candidates

1 Which row describes the Sun and the Milky Way?

	the Sun	the Milky Way
A	a galaxy	a galaxy
B	a galaxy	a star
C	a star	a galaxy
D	a star	a star

2 What is the approximate diameter of the Milky Way?

A 100 light-years

B 1000 light-years

C 10 000 light-years

D 100 000 light-years

3 Which statement about the Sun is **not** correct?

A The Sun is one of the biggest stars.

B The Sun emits ultraviolet radiation.

C The Sun emits infrared radiation.

D Helium is present in the Sun.

4 Which statement about the Milky Way galaxy is correct?

A It contains stars that are about the same distance from the Earth as the Sun.

B It is a collection of about 1000 stars that can be seen from the Earth.

C It is the galaxy that contains the Sun and the Earth.

D Its diameter is about 1 light-year.

5 What are the three main types of radiation emitted by the Sun?

A infrared, radio waves and ultraviolet

B infrared, visible light and ultraviolet

C microwaves, visible light and X-rays

D radio waves, X-rays and ultraviolet

6 What is a light-year?

A the time for light to travel 1 km in space

B the time for light to travel from the Sun to the Earth

C the distance travelled in space by light in one year

D the distance travelled by light from the Sun to the Earth

7 What makes up the Universe?

A many billions of galaxies

B Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus and Neptune only

C the Sun, the Earth and the Moon only

D the Solar System only

8 The Sun mostly consists of which gases?

A helium and hydrogen

B helium and nitrogen

C hydrogen and oxygen

D oxygen and nitrogen

9 Which statement about the Sun is correct?

A The Sun is a dwarf star consisting mostly of hydrogen and oxygen.

B The Sun is a giant star consisting mostly of helium and carbon dioxide.

C The Sun is a medium-sized star consisting mostly of hydrogen and helium.

D The Sun is a medium-sized star consisting mostly of nitrogen and oxygen.

10 Which quantity does a light-year measure?

A an angle

B a distance

C a speed

D a time

11 The Sun transfers energy to the Earth through electromagnetic radiation.

What are two of the parts of the electromagnetic spectrum to which most of the energy belongs?

A gamma rays and X-rays

B infrared radiation and visible light

C microwaves and visible light

D radio waves and microwaves

12 What provides evidence that the Universe is expanding?

A Stars in galaxies outside the Milky Way are all red.

B The Andromeda galaxy is moving toward the Milky Way.

C Light from distant galaxies is shifted to longer wavelengths.

D The Universe is 14 billion years old.

13 The Sun consists mostly of two elements.

What are these two elements?

A helium and nitrogen

B hydrogen and helium

C hydrogen and oxygen

D oxygen and nitrogen

14 Which statement about the Milky Way is correct?

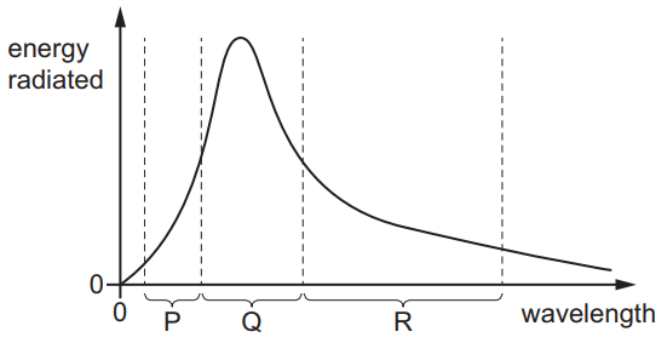
A It is a galaxy.

B It is a group of galaxies.

C It is a group of stars outside our own galaxy.

D It is a group of stars which are part of our galaxy.

15 The graph shows the energy radiated by the Sun at different wavelengths. Most of the energy is radiated in just three parts of the electromagnetic spectrum, labelled P, Q and R.



Which parts of the electromagnetic spectrum are P and R?

	P	R
A	gamma ray	radio
B	infrared	ultraviolet
C	radio	gamma ray
D	ultraviolet	infrared

16 An astronomer observes redshift in the light from a distant galaxy.

Which statement about redshift is correct?

A It is the decrease in the observed wavelength of red light emitted from receding galaxies.

B It is evidence that the Universe is contracting and supports the Big Bang Theory.

C It is evidence that the Universe is expanding and supports the Big Bang Theory.

D Redshift is when light from receding galaxies appears blue.

Paper 2

Questions are applicable for both core and extended candidates unless indicated in the question

17 Which statement about the Sun is correct? **(extended only)**

A The nuclear reactions in the Sun create mainly radio waves and microwaves.

B The Sun is powered by fission reactions in which hydrogen is converted into helium.

C The Sun is powered by fission reactions in which lithium is converted into helium.

D The Sun is powered by fusion reactions and electromagnetic radiation is produced.

18 To determine the value of the Hubble constant, an astronomer measures the distance of a galaxy from the Earth as 2.5×10^{21} km. **(extended only)**

She also measures the speed of recession of the galaxy from the Earth as 5.2×10^{3} km/s.

From these data, what is the value of the Hubble constant?

A $7.7 \times 10^{-26}\,s^{-1}$

B $2.1 \times 10^{-18}\,s^{-1}$

C $4.8 \times 10^{17}\,s^{-1}$

D $1.3 \times 10^{25}\,s^{-1}$

19 What happens when a protostar becomes a stable star? **(extended only)**

A Most of the hydrogen is converted to helium and the protostar expands.

B The inward force due to gravity is balanced by an outward force due to the high temperature.

C The protostar collapses due to gravity and the temperature increases.

D The protostar runs out of hydrogen as fuel for the nuclear reaction.

20 Which quantity is an estimate of the age of the Universe? **(extended only)**

A H_0 **B** $d \times H_0$ **C** $\frac{1}{H_0}$ **D** $v \times H_0$

21 What is the main process that powers the Sun? **(extended only)**

A burning of helium and oxygen

B burning of hydrogen and oxygen

C nuclear fusion of hydrogen to form helium

D nuclear fission of helium to form hydrogen

22 A galaxy is 3.0×10^{20} km from the Earth. **(extended only)**

At which speed is the galaxy moving away from the Earth?

A 660 km/s **B** 6600 km/s **C** 660 m/s **D** 6600 m/s

23 An astronomer observes a distant galaxy. **(extended only)**

The table shows how the distance and the speed of recession of the galaxy are determined.

Which row is correct?

	distance	speed of recession
A	brightness of a supernova in the galaxy	change in wavelength of starlight from the galaxy
B	brightness of a supernova in the galaxy	brightness of the galaxy
C	brightness of the galaxy	change in wavelength of starlight from the galaxy
D	brightness of the galaxy	brightness of a supernova

24 Which statement about the life cycle of a star is correct? **(extended only)**

A All stars eventually run out of hydrogen as fuel.

B A red giant forms a planetary nebula with a supernova at its centre.

C A white dwarf star eventually forms a black hole.

D Most stars expand and form protostars.

25 A galaxy at a distance of 3.1×10^{21} km is moving away from the Earth with a speed of 7000 km/s.

What is the Hubble constant H_0 calculated using this data and what is the speed of a galaxy at a distance of 6.2×10^{21} km from the Earth? **(extended only)**

	H_0 / s^{-1}	speed of galaxy / km/s
A	2.3×10^{-18}	3 500
B	2.3×10^{-18}	14 000
C	4.4×10^{17}	3 500
D	4.4×10^{17}	14 000

26 The table lists some information about some stars. **(extended only)**

Which star will eventually explode as a supernova?

	name of star	type of star	temperature / °C
A	Aldebaran	red giant	3 700
B	Betelgeuse	red supergiant	3 300
C	Geminga	neutron star	520 000
D	Sirius B	white dwarf	25 000

27 What is the definition of the Hubble constant? **(extended only)**

A the ratio of the speed at which a galaxy is receding from the Earth to its distance from the Earth

B the value of the change in wavelength of the galaxy's starlight due to redshift

C the constant used to represent the rate of expansion of the Universe in all directions

D the estimated constant equal to the age of the Universe

28 Which nuclear reaction produces the release of energy to power a star? **(extended only)**

A nuclear fission of helium into hydrogen

B nuclear fission of hydrogen into helium

C nuclear fusion of helium into hydrogen

D nuclear fusion of hydrogen into helium

29 The Sun transfers energy to the Earth through electromagnetic radiation.

What are two of the parts of the electromagnetic spectrum to which most of the energy belongs?

A gamma rays and X-rays

B infrared radiation and visible light

C microwaves and visible light

D radio waves and microwaves

30 How does the Sun produce its energy? **(extended only)**

A by the fission of helium

B by the fission of hydrogen

C by the fusion of helium

D by the fusion of hydrogen

31 Which nuclear reaction powers a stable star? **(extended only)**

A nuclear fission of nuclei producing hydrogen

B nuclear fission of a uranium nucleus into a krypton nucleus and a barium nucleus

C nuclear fusion of a krypton nucleus and a barium nucleus into a uranium nucleus

D nuclear fusion of hydrogen nuclei producing helium

32 Which stages in the life cycle of a star are listed in the order that they occur? **(extended only)**

A interstellar dust cloud → stable star → protostar

B protostar → red giant → stable star

C red giant → white dwarf → protostar

D stable star → red giant → white dwarf