Physics
Standard Grade

Unit 7
Space Physics
General & Credit Past Paper Questions

Record Sheet

General - Section	Question	Attempted	RED	AMBER	GREEN
Multiple Choice	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
1.Signals from Space	10				
	11				
	12				
	13				
	14				
	15				
	16				
2.Space Travel	17				
	18				
	19				
	20				
	21				

Credit - Section	Question	Attempted	RED	AMBER	GREEN
1.Signals from Space	22				
	23				
	24				
	25				
	26				
	27				
2.Space Travel	28				
	29				
	30				
	31				
	32				

RED - I don't understand the question
I NEED HELP!

AMBER - I understand most of the question
I NEED TO REVISE A LITTLE MORE!

GREEN - I got the correct answer first time!!
I UNDERSTAND THIS TOPIC

KU	PS

General Level

Answer questions in your Homework Jotter.
Show working for each question.

1.

When a spacecraft re-enters the Earth's atmosphere, some

A heat is transferred to potential energy
B heat is transferred to kinetic energy
C kinetic energy is transferred to potential energy
D potential energy is transferred to heat
E kinetic energy is transferred to heat.

2.

Approximately how long does it take light to travel from the Sun to the Earth?

A 8 seconds
B 8 minutes
C 8 hours
D 8 days
E 8 years

3.

Deep in outer space, the rocket engine of a space probe is fired for a short time and then switched off.

A accelerates forwards
B decelerates until it stops
C changes direction
D follows a curved path
E moves at a steady speed.

4.

What is the purpose of the objective lens in a telescope?

A To bring stars closer to the observer
B To detect radio waves from distant stars
C To magnify the image produced by the eyepiece
D To produce an image that is magnified by the eyepiece
E To split light from stars into different colours

5.

When a spacecraft enters the Earth's atmosphere, one effect of friction is to

A potential energy into kinetic energy
B kinetic energy into potential energy
C heat into potential energy
D potential energy into heat
E kinetic energy into heat.

6.

Which of the following is the shortest distance?
The distance from the Earth to the

A nearest star in our galaxy
B edge of our galaxy
C Moon
D Sun
E nearest planet.

7.

Radio waves from space can be detected by a

A Geiger-Müller tube
B photographic plate
C scintillation counter
D telescope
E tuner.

KU	PS

General Level

Answer questions in your Homework Jotter.
Show working for each question.

8.

A rocket is pushed forwards because its engine gases

A are pushed backwards
B spread outwards
C are pushed forwards
D surround the rocket
E spread inwards.

9.

In outer space, the engine of a space probe is switched on for a short time. When the engine is switched off, the rocket

A changes direction
B moves at a steady speed
C slows down
D speeds up
E follows a curved path.

General Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

10. Read the following passage.

On clear nights it is possible to see light from many of the stars in our galaxy. In addition, some of the planets in our solar system can be seen because they reflect sunlight.

One star in our galaxy which often appears bright in the sky is called Sirius. The light from Sirius which arrives on Earth tonight started out on its journey from the star in the middle of 1991.

(*a*) How long, to the nearest year, does light take to reach Earth from Sirius? **1**

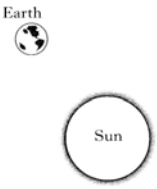
(*b*) Which terms **used in the passage** mean

a body that orbits a star

a large cluster of stars

a glowing ball of gas? **3**

(*c*) The diagram below shows the Sun, the Earth and the planet Jupiter. (The diagram is not to scale.)



Show how Jupiter can be seen from Earth by adding rays of light to the diagram, and giving the direction the light travels. **2**

(*d*) Arrange the following in order of distance from Earth.

edge of our galaxy **Sirius** **Sun**

Nearest to Earth	⟶	*Furthest from Earth*

(*e*) Scientists obtain information about a star by splitting light from it into different colours. **2**

(i) What is the name of the glass shape that is used to split light into different colours? **1**

(ii) Light from a star produces a line spectrum.

What information about the star can be obtained from this spectrum? **1**

General Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

11.

(*a*) An astronomer views the following objects in the night sky:

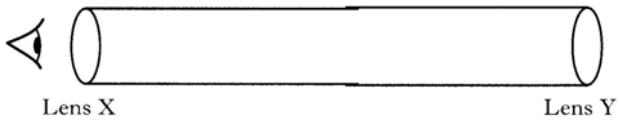
Jupiter, which orbits the Sun;
Europa, which orbits Jupiter;
the Andromeda Galaxy.

(i) Which of the objects mentioned is a moon? **1**

(ii) Which of the objects mentioned is a planet? **1**

(iii) Which of the objects mentioned is a star? **1**

(*b*) A telescope consists of two lenses, X and Y, in a light-tight tube.



Complete the following statements about the lenses in this telescope, using the words or phrases from the list.

eyepiece **objective** **magnify** **collect light**

(i) Lens X is called the ..... lens. Its purpose is to

..... **1**

(ii) Lens Y is called the ..... lens. Its purpose is to

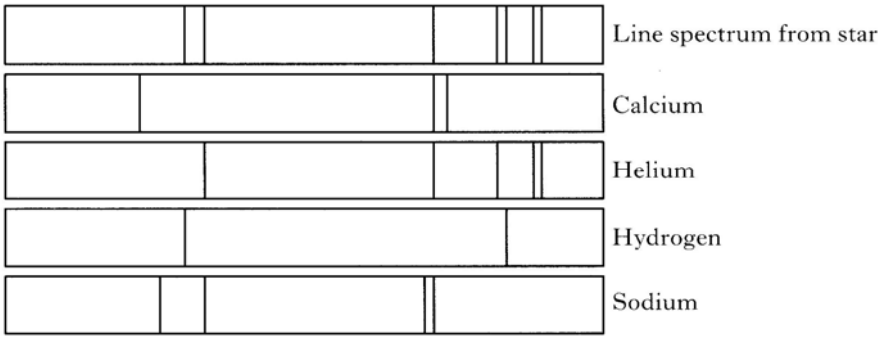
..... and produce an image of the object. **1**

12.

Light from a star is split into a line spectrum, of different colours.

(*a*) What is the name of a glass shape that is used to split light into different colours? **1**

(*b*) The line spectrum from the star is shown, along with the line spectra of the elements calcium, helium, hydrogen and sodium.



Use this information to identify the elements present in the star. **2**

General Level

Answer questions in your Homework Jotter.
Show working for each question.

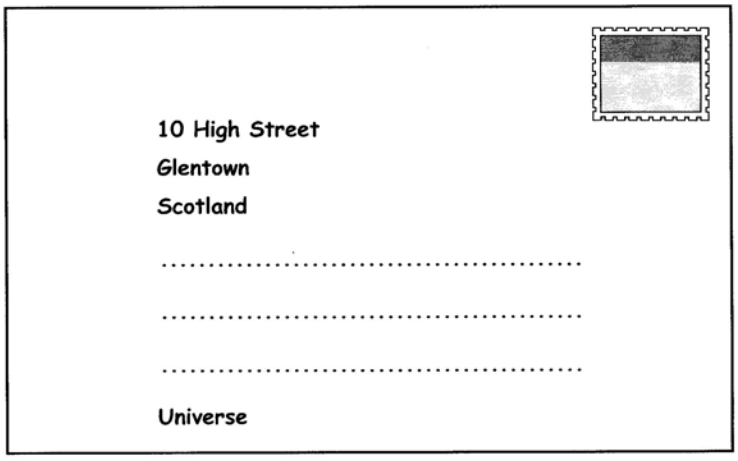
KU	PS

13. A boy is interested in astronomy.

(*a*) The boy writes his address in the Universe.

Complete the address given below by writing, **in the correct order**, the missing lines using terms from the following list.

Earth **Milky Way (our galaxy)** **Solar System**



2

(*b*) The boy reads the following passage in an astronomy book.

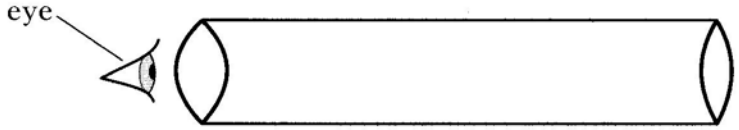
You can view planets, moons and stars using a telescope.
Jupiter, the largest planet in our Solar System, takes 12 Earth years to orbit the Sun. The largest of Jupiter's many moons is called Ganymede.
Sirius, also known as the dog star, is the brightest star in the sky, apart from the Sun.

(i) Name one astronomical object, **mentioned in the passage**, that can only be seen by reflected light. 1

(ii) Name one astronomical object, **mentioned in the passage**, that generates light. 1

(iii) Which object, **mentioned in the passage**, is furthest away from Earth? 1

(iv) Complete the diagram of a telescope below, by naming the two lenses.



....
lens lens

2

General Level

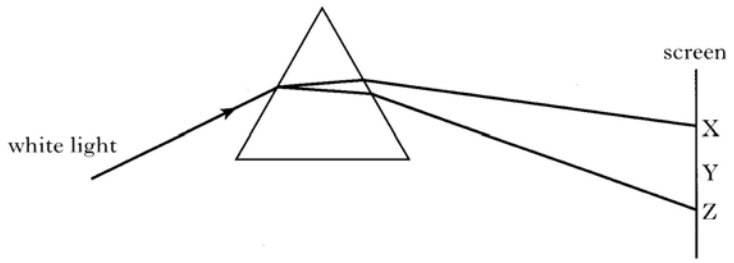
Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

14. White light is part of the electromagnetic spectrum–a family of waves with different wavelengths.

(*a*) What property do all these waves have in common? **1**

(*b*) White light can be split into different colours.



(i) What is the name of the glass block that is used to split light into different colours? **1**

(ii) The colours appear on the screen in order of wavelength. The colour with the longest wavelength appears at X.

Which of the colours blue, green and red is seen on the screen at each position X, Y and Z? **2**

(iii) Which of the colours blue, green and red has the highest **frequency**? **1**

15. The table below gives some information about planets and other objects in our Solar System.

	Distance from the Sun (million kilometres)	*Weight of 1 kilogram at the surface (newtons)*
Sun	0	270
Mercury	58	4
Venus	110	9
Earth	150	10
Moon	150	1·6
Mars	228	4
Jupiter	780	26
Saturn	1430	11
Neptune	4500	12

(*a*) Name **one** object in the table that is **not** a planet. **1**

(*b*) Which planet is nearest to Earth? **1**

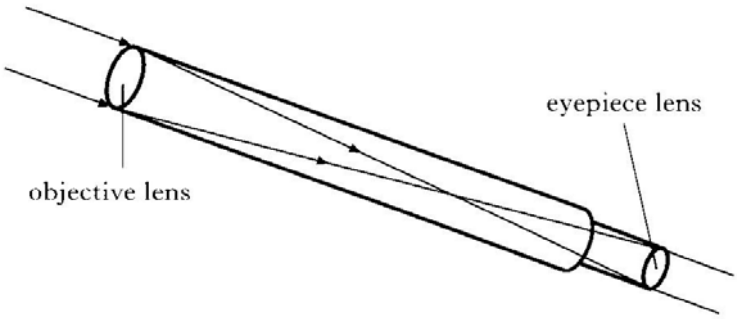
(*c*) On which **two** planets would a 5 kilogram mass have the same weight? **1**

General Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

16. The diagram below shows a refracting telescope, which is used by astronomers to view distant stars, planets and galaxies.



(*a*) (i) Which lens, the objective or the eyepiece, has the longer focal length? **1**

(ii) What is the purpose of the eyepiece lens? **1**

(*b*) The table gives information about some of the planets in our Solar System.

Planet	*Diameter* (kilometres)	*Distance from Sun* (million kilometres)	*Weight of one kilogram at surface* (newtons)	*Time to go around the Sun once* (years)	*Time for one complete spin* (in Earth days or hours)
Mercury	4800	58	4	0·25	59 days
Venus	12 000	110	9	0·6	243 days
Earth	12 750	150	10	1	24 hours
Mars	7000	228	4	1·9	25 hours
Jupiter	140 000	780	26	12	10 hours
Saturn	120 000	1430	11	30	10 hours
Neptune	50 000	4500	12	165	16 hours

(i) Which planet has the longest day? **1**

(ii) Which planet has the longest orbit? **1**

(iii) On which planet would a 4 kilogram mass have the greatest weight? **1**

(*c*) A meteorite is the name given to an object which enters the Earth's atmosphere from space. When they enter the atmosphere, meteorites heat up.

State the energy change when the meteorite enters the atmosphere. **2**

(*d*) Stars and planets belong to galaxies.

What is a galaxy? **1**

General Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

17.

In the passage below, circle **one** word or phrase in each set of brackets to make the statements correct.

A large stone and a small stone of the same material are kicked horizontally off a cliff at the same time.

Both stones follow a {curved / straight / vertical} path.

Ignoring air resistance, the stones have the same {acceleration / mass / weight}

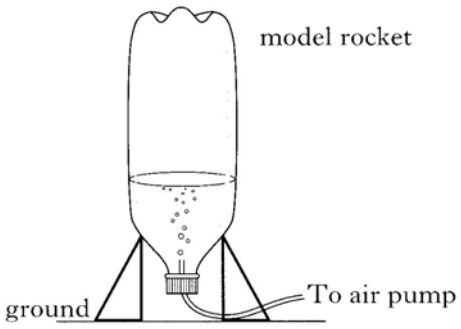
because of the {force of friction. / force of gravity. / kick.}

It is found that {the large / the small / neither} stone reaches the ground first.

4

18.

A model rocket is made from an upturned plastic bottle containing some water. Air is pumped into the bottle.



When the water is released, the rocket rises.

In the passage below, circle **one** word in each set of brackets to make the statements correct.

When the rocket rises, it exerts a force {downwards / upwards} on the {ground / air / water}

and the {ground / air / water} exerts a force {downwards / upwards} on the rocket.

2

General Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

19.

A space probe is travelling between Earth and Mars. The mass of the probe is 75 kilograms. A rocket motor on the probe supplies a thrust of 900 newtons when it is fired.

(*a*) Earth and Mars are planets.
What is a planet? **1**

(*b*) The rocket motor is fired at a point, between Earth and Mars, where the effects of gravity can be ignored.
Calculate the acceleration of the probe when the rocket motor is fired. **2**

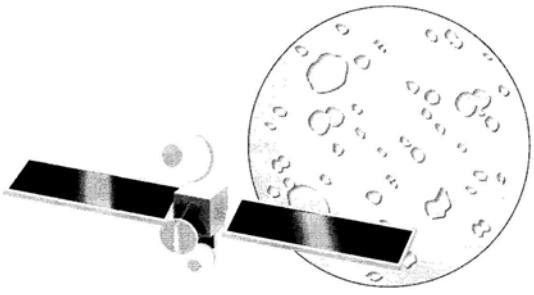
(*c*) For most of the journey from Earth to Mars, the rocket motor on the probe is switched off.
Explain, with reference to a law of motion, why this is possible. **2**

(*d*) The probe lands on the surface of Mars.
Circle **one** phrase in the passage below to make the statement correct.

The weight of the probe on Mars is { the same as its weight on Earth / zero / different from its weight on Earth }. **1**

20.

A spacecraft is fitted with a motor that uses electrical energy generated from sunlight. The motor is designed to propel the spacecraft from the Earth to the Moon. The mass of the spacecraft is 420 kilograms.



(*a*) Name a suitable device that can be used to transform light into electrical energy. **1**

(*b*) The spacecraft has an acceleration of 0·2 millimetre per second per second when the motor is first switched on.
Calculate the thrust acting on the spacecraft. **2**

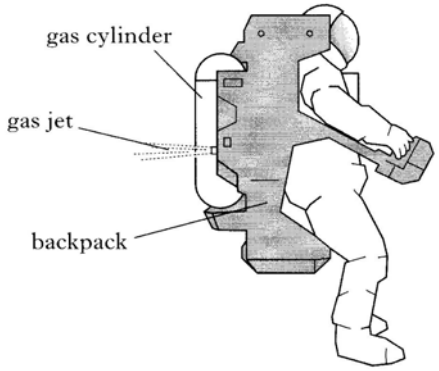
(*c*) The motor provides thrust for the spacecraft by expelling gas at very high speed. Explain why the spacecraft moves forward when the gas is expelled. **1**

General Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

21. A spacecraft is far out in space. An astronaut wearing a backpack leaves the spacecraft. The astronaut uses the backpack to move around. The backpack contains a pressurised gas cylinder connected to a valve. When the valve is opened, a jet of gas is released.



(*a*) Complete the passage below by circling the correct answer.

When the astronaut opens the valve, the cylinder pushes gas backwards.

The gas pushes the { cylinder / jet / spacecraft } forwards. **1**

(*b*) The astronaut and backpack have a combined mass of 120 kilograms. The jet of gas exerts a constant thrust of 24 newtons.

(i) Calculate the acceleration of the astronaut when the jet is switched on. **2**

(ii) The jet is now switched off.

Describe the motion of the astronaut.

Explain your answer. **1**

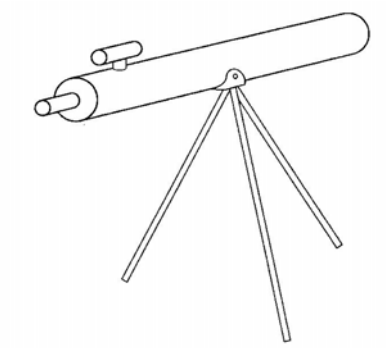
Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

22.

A refracting telescope has an objective lens which has a focal length of 800 mm and a diameter of 50 mm.



The telescope can be fitted with any one of three eyepiece lenses Q, R or S. Information on these lenses is shown in the table.

Lens	*Focal length* (mm)	*Diameter* (mm)
Q	10	5
R	20	5
S	40	5

(*a*) Why is it important to make the diameter of the **objective** lens as large as possible? **1**

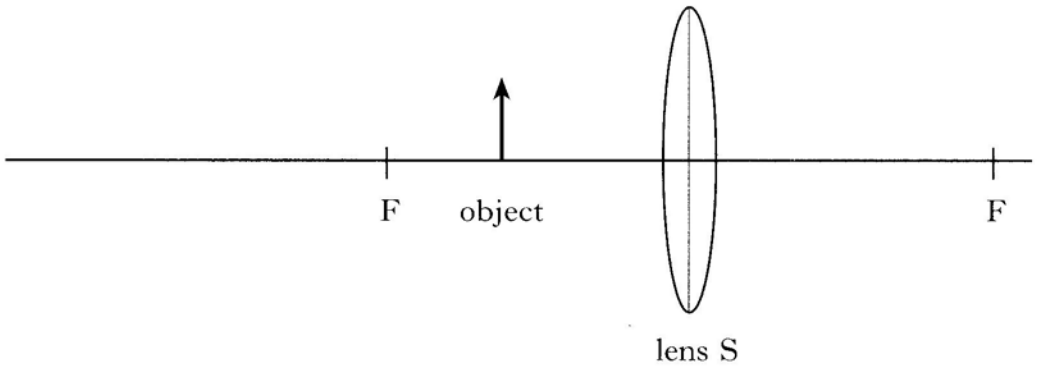
(*b*) (i) Calculate the power of lens R. **2**

(ii) Which of the three eyepiece lenses has the greatest power? **1**

(*c*) Each eyepiece lens can be used on its own as a magnifying glass.

Complete the diagram below to show how lens S can be used to form a magnified image of an object.

The points marked F are one focal length from the centre of the lens.



3

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

23.

Read the following passage about the launching of a space observatory using the Space Shuttle Columbia.

In July 1999, NASA used the Space Shuttle Columbia to launch a space-based observatory, called the Chandra X-ray Observatory.

This observatory is designed to detect X-rays emitted by objects in our solar system and beyond. X-rays are absorbed by the Earth's atmosphere, so a space-based observatory is necessary to detect them. Signals are sent from the observatory to Earth using radio waves.

There are now three observatories orbiting the Earth. The other two are the Hubble Space Telescope that detects visible light and the Compton Gamma Ray Observatory.

(*a*) Why is it necessary to site an observatory in space to detect X-rays? **1**

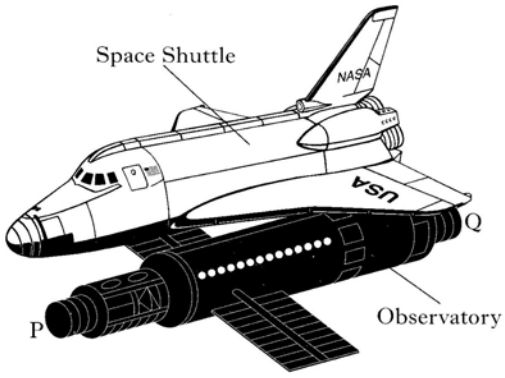
(*b*) Four members of the electromagnetic spectrum are mentioned in the passage. Complete the diagram by placing these members in the correct order of wavelength. **4**

		Ultraviolet		Infrared	Microwaves	

The electromagnetic spectrum

(*c*) Explain why different kinds of observatory are used to detect signals from space. **2**

(*d*) When the Space Shuttle reached the correct height above Earth, the observatory was separated from it.



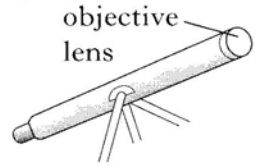
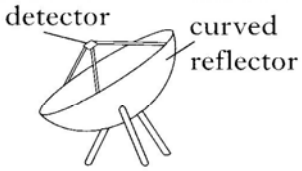
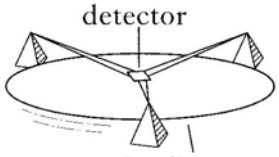
Two rocket motors P and Q on the observatory, as shown, were used during the separation. The observatory accelerated away from the space shuttle for a short time. It then remained at a fixed distance ahead of the space shuttle. Describe how the rockets P and Q were used during this separation. **2**

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

24. The table below has information about three telescopes used to detect radiation from space.

	Refracting telescope in Edinburgh, with 150 mm diameter objective lens.
	Radio telescope at Jodrell Bank, with a curved reflector of diameter 76 m.
	Radio telescope at Arecibo, Puerto Rico, with a curved reflector of diameter 300 m.

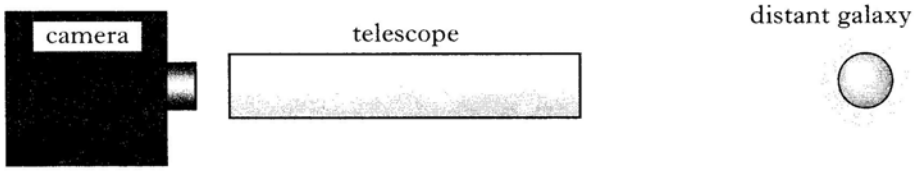
(*a*) What type of radiation is detected by a refracting telescope? — 1

(*b*) Why are different types of telescope used to detect radiation from space? — 1

(*c*) In a radio telescope, where is the detector placed in relation to the curved reflector? — 1

(*d*) Explain which of the three telescopes shown above is best for detecting very weak radio signals from deep space. — 2

25. An astronomer uses a telescope and a camera to take a photograph of a distant galaxy.



(*a*) The table shows a number of lenses that are available for use in the telescope.

lens	*type*	*focal length* (mm)	*diameter* (mm)
P	concave	15	10
Q	convex	15	10
R	convex	1000	10
S	convex	1000	100
T	concave	1000	100

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

25. continued

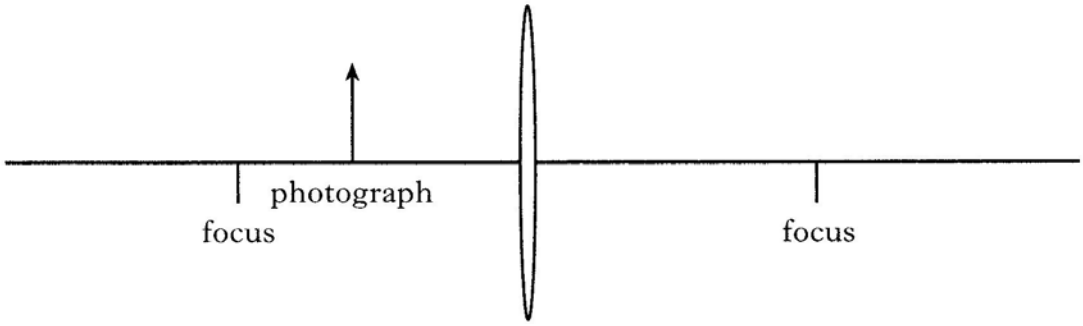
From the table, select the most suitable lenses for use as the eyepiece and the objective of the telescope.

Eyepiece ☐ Objective ☐ **2**

(*b*) The astronomer examines the photograph using a magnifying glass.

Complete the ray diagram to show how the magnifying glass can be used to form an image of the photograph.

Your diagram must show the position of the image.



3

26.

Titan is the largest of Saturn's moons. The gravitational field strength on Titan is 1·35 N/kg.

(*a*) (i) What is a moon? **1**

(ii) What is meant by gravitational field strength? **1**

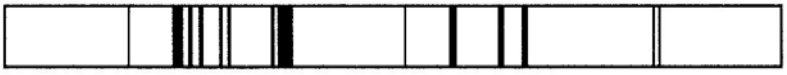
(*b*) Early in 2005, a probe was released from a spacecraft orbiting Titan. The probe, of mass 318 kg, travelled through the atmosphere of Titan.

(i) Calculate the weight of the probe on Titan. **2**

(ii) As the probe descended through the atmosphere, a parachute attached to it opened.

State why the parachute was used. **1**

(iii) The probe carried equipment to analyse the spectral lines of radiation from gases in the atmosphere of Titan. These lines are shown. The spectral lines of a number of elements are also shown.



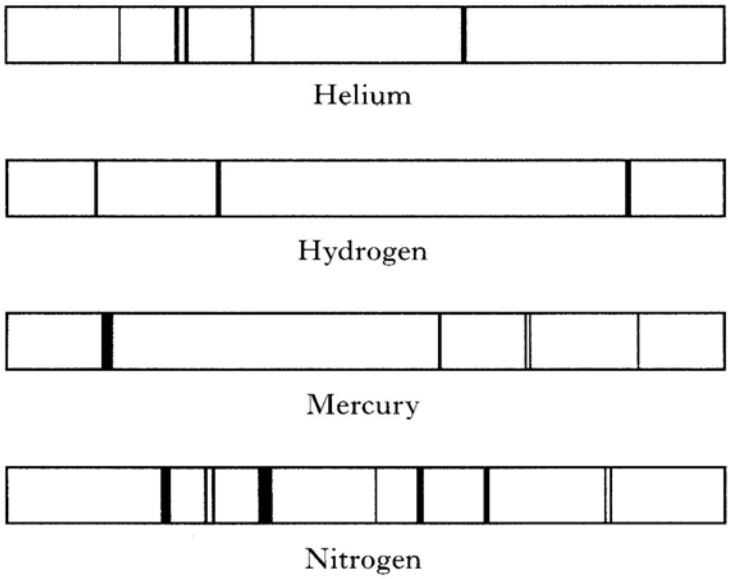
Spectral lines from gases in Titan's atmosphere

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

26. (b) continued



Use the spectral lines of the elements to identify which elements are present in the atmosphere of Titan. **2**

27.

The diagram represents the electromagnetic spectrum in order of increasing wavelength. Some of the radiations have not been named.

Electromagnetic Spectrum

Gamma rays	**P**	Ultraviolet	**Q**	Infrared	**R**	TV and Radio

increasing wavelength

(*a*) (i) Name radiation: **P** **Q** **R** **2**

(ii) Which radiation in the electromagnetic spectrum has the highest frequency? **1**

(*b*) Stars emit **ultraviolet** and **infrared** radiation.

Name a detector for **each** of these two radiations.

Infrared.....

Ultraviolet..... **2**

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

28.

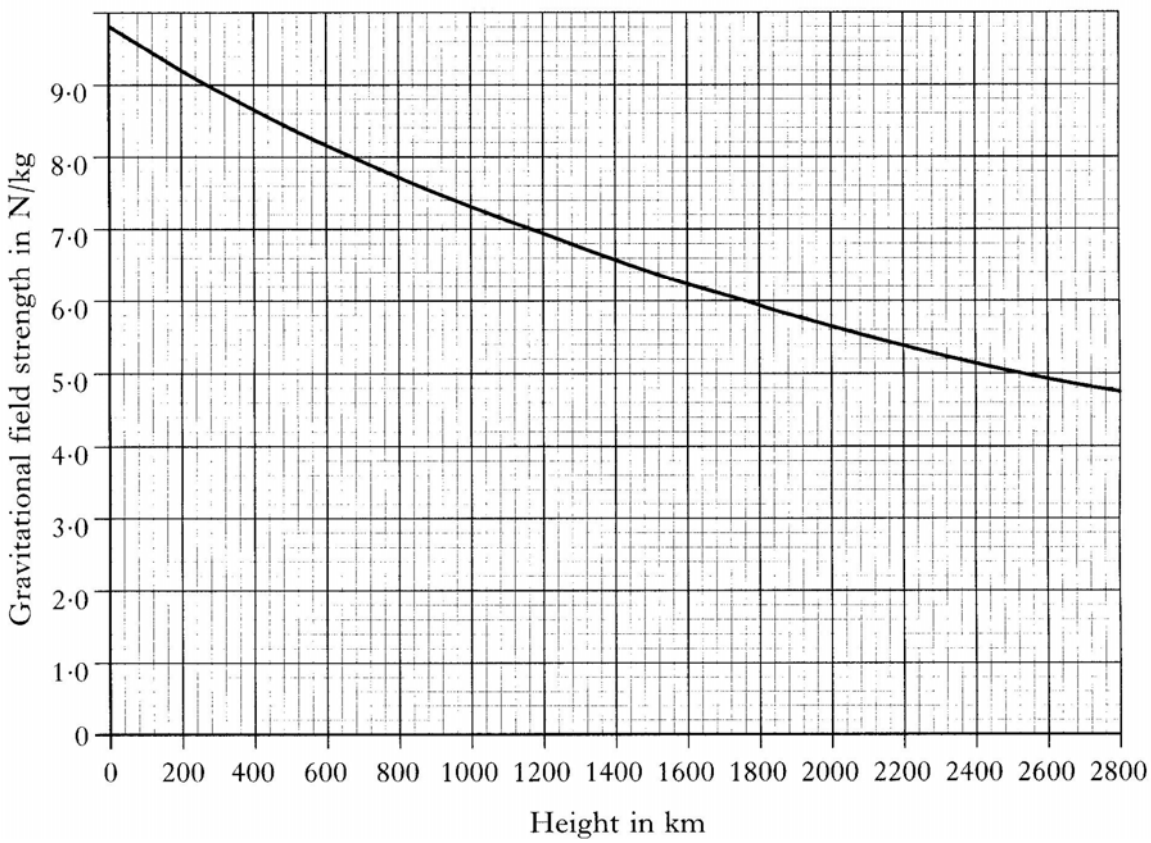
The International Space Station orbits Earth at a height of 360 km. The command module of the space station has a mass of 20 tonnes (20×10^3 kg).

(*a*) Masses as large as this are difficult to accelerate.

Circle the term that is used for this concept.

gravitational field strength **inertia** **thrust** **weight**

(*b*) The graph shows how the gravitational field strength varies with height above the surface of the Earth.



(i) What is the value of the gravitational field strength at the orbital height of the International Space Station? **1**

(ii) Calculate the weight of the command module at this height. **2**

(iii) As the command module is taken from Earth to its orbital height, what happens to its weight and mass? **2**

(*c*) The International Space Station is an artificial satellite.

Explain why it remains in orbit around the Earth. **2**

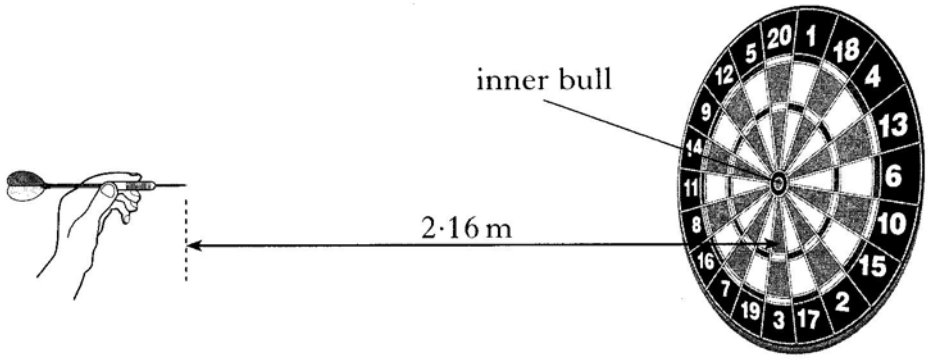
Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

29.

A darts player throws a dart horizontally at the centre of the inner bull. The dart leaves the player's hand at a distance of 2·16 m from the dartboard and with a horizontal speed of 12·0 m/s.



(*a*) Calculate the time taken for the dart to travel from the hand to the board. **2**

(*b*) Explain why the dart follows a curved path in its flight to the board. **2**

(*c*) The average vertical speed of the dart during its flight to the board is 0·9 m/s.

How far below the centre of the inner bull does the dart hit the board? **2**

30.

A space vehicle consists of a rocket engine, fuel and a probe. When sitting on the launch pad, the total mass of the space vehicle is 150 000 kg.

(*a*) Calculate the weight of the space vehicle on the launch pad. **2**

(*b*) The space vehicle is launched. Shortly after lift-off, it is at a height of 650 km above the surface of the Earth. At this time, 80 000 kg of fuel have been used.

Give **two** reasons why the weight of the space vehicle is now less than it was on the launch pad. **2**

(*c*) The space vehicle travels into a region of space where the gravitational field strength is zero. The engine is now switched off.

Describe and explain the motion of the vehicle. **2**

Credit Level

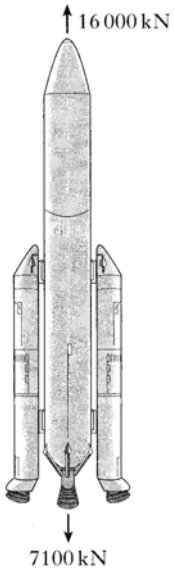
Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

31.

A spacecraft consisting of a rocket and a lunar probe is launched from the Earth to the Moon.

(*a*) At lift-off from the Earth, the spacecraft has a weight of 7100 kN. The thrust from the engines is 16 000 kN.



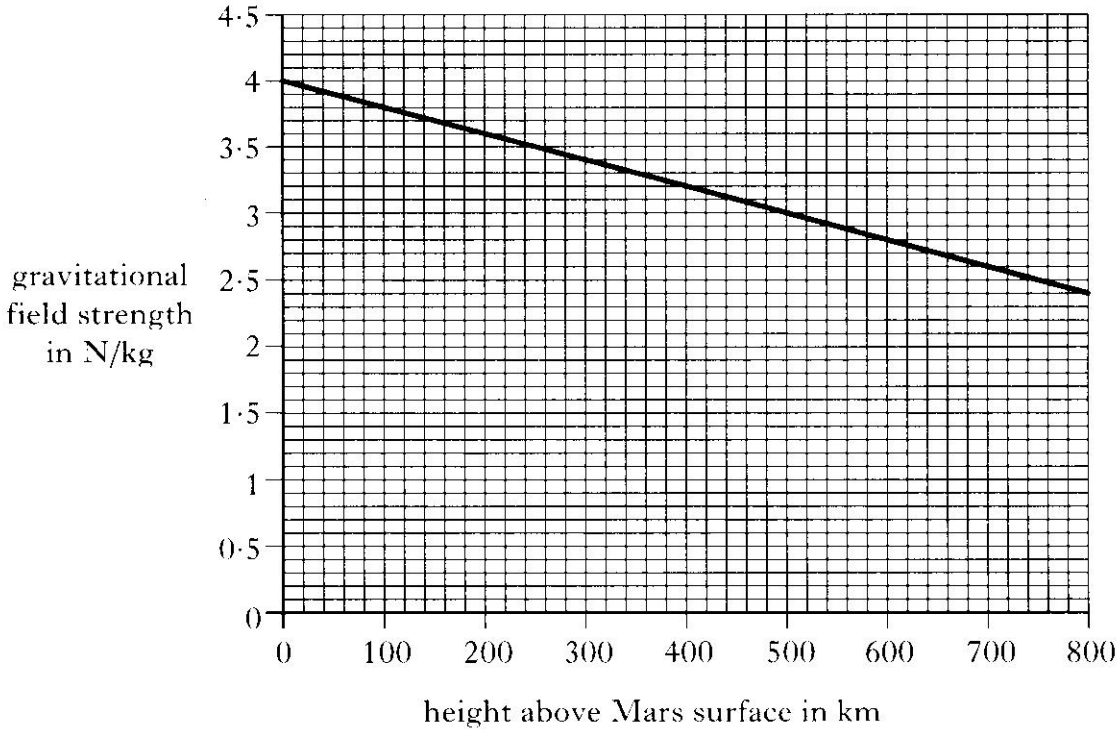
(i) Calculate the unbalanced force acting on the spacecraft. **1**

(ii) Calculate the mass of the spacecraft. **1**

32.

In June 2005, a space vehicle called Mars Lander was sent to the planet Mars.

(*a*) The graph shows the gravitational field strength at different heights above the surface of Mars.



Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS

32. continued

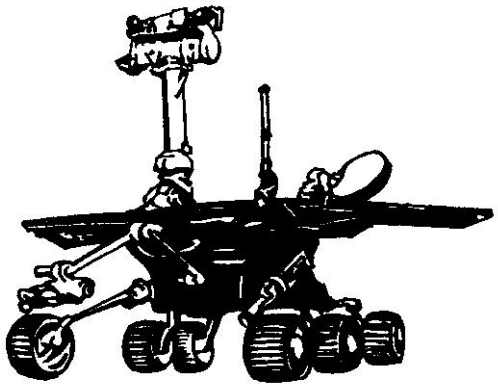
(i) The Mars Lander orbited Mars at a height of 200 km above the planet's surface.

What is the value of the gravitational field strength at this height? **1**

(ii) The Mars Lander, of mass 530 kg, then landed.

Calculate the weight of the Mars Lander on the surface. **3**

(*b*) The Mars Lander released a rover exploration vehicle on to the surface of Mars.



To collect data from the bottom of a large crater, the rover launched a probe horizontally at 30 m/s. The probe took 6 s to reach the bottom of the crater.

(i) Calculate the horizontal distance travelled by the probe. **2**

(ii) Calculate the vertical speed of the probe as it reached the bottom of the crater. **2**

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