1.5 Space Exploration Past Paper Questions

Q1. Name 2 pieces of technology developed as a result of space exploration. Explain how space exploration led to the development of these technologies. (4)

Q2. List 2 risks associated with space exploration. (2)

Q3. In what ways has our model of the universe changed over time? Name a recent development in physics and explain how this has affected our model of the universe. (3)

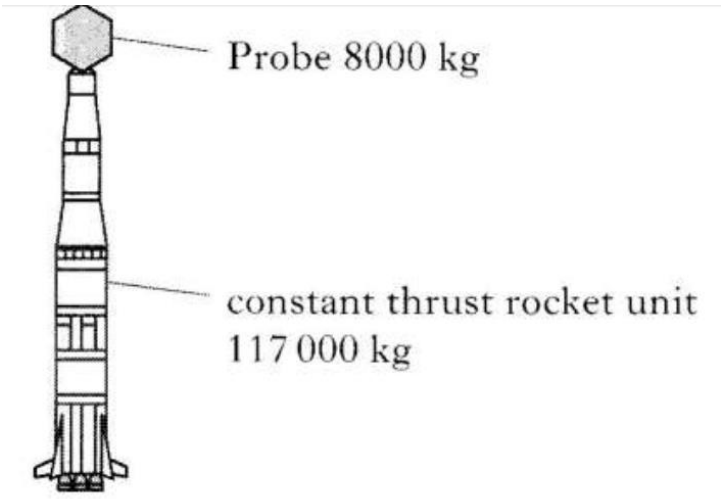
Q4. Explain how space exploration has improved our understanding of Earth and the universe. Include at least 3 points in your answer. (3)

Q5. "Space exploration costs too much money. We should be spending the money solving problems here on Earth before we explore space."

Do you agree or disagree with this statement?

Write an essay discussing this point. Remember to justify your opinion. (4)

Q6 A space probe is designed to record data on its way to landing on Ganymede, a moon of Jupiter. The launch vehicle is made up of the probe of mass 8000 kg and the constant thrust rocket unit which has a mass of 117 000 kg.



On launch, the resultant force acting upwards on the launch vehicle is 1 400 000N.

a) Calculate the initial acceleration of the launch vehicle. (3)
b) As the launch vehicle continues to ascend, its acceleration increases. This is partly due to the decrease in gravitational field strength as it gets further from Earth. Give another reason why the acceleration increases. (1)

Q7 The first manned space flights took place 50 years ago. Spacecraft were launched into space using powerful rockets.

a) The operation of a rocket engine can be explained using Newton's Third Law of Motion.
   i) State Newton's Third Law of Motion. (1)
   ii) Explain, in terms of Newton's Third Law, how the rocket engines propel the rocket upward. (1)
b) At lift-off, one rocket has a total mass of 2.05×10^6 kg. The resultant force acting upwards on the rocket is 8.2×10^6 N.
   Calculate the acceleration of the rocket at lift-off. (3)

Q8 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. (3)
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)

Q9 A water rocket consists of a plastic bottle containing air and water.

A bicycle pump is used to increase the pressure of the air in the bottle. When the pressure is high enough the plastic bottle is fired upwards.

a) i) The air inside the plastic bottle exerts a downward force on the water. Describe the force exerted by the water. (1)

ii) At one stage of the flight, the rocket has a mass of 0.70 kg. The unbalanced force on the rocket is 2.1 N.

Calculate the acceleration of the rocket. (3)

b) A space rocket can escape the gravitational pull of the Earth if the rocket engine has enough thrust. An identical rocket would need less thrust if it is launched from the Moon.

Explain why less thrust is needed if the rocket is launched from the Moon. (1)

Q10 A spacecraft is orbiting the Earth. Scientists prepare to bring it back to the Earth's surface.

a) To safely enter the Earth's atmosphere, the speed of the spacecraft must be decreased. This is achieved by thruster rockets.
The spacecraft has a mass of 6000 kg and the thruster rockets create a combined thrust of 4800N.
Calculate the deceleration of the spacecraft when the thruster rockets fire. (3)

b) The thruster rockets are now switched off. A heat resistant tile breaks off the spacecraft. The force of gravity near the Earth causes both the spacecraft and the tile to accelerate towards the Earth.
When the objects enter the Earth's atmosphere some of the kinetic energy is transformed into heat.
Name the force that causes this energy transformation. (1)

Q11 A spacecraft is used to transport astronauts and equipment to a space station. On its return from space the spacecraft must re-enter the Earth's atmosphere. The spacecraft has a heat shield made from special silica tiles to prevent the inside from becoming too hot.

a) Why does the spacecraft increase in temperature when it re-enters the atmosphere? (1)

b) The mass of the heat shield is 3.5×10^3 kg and the gain in heat energy of the silica tiles is 4.7 GJ.
Calculate the increase in temperature of the silica tiles. (3)

c) Explain why the actual temperature rise of the silica tiles is less than the value calculated in part b). (1)

d) When a piece of equipment was loaded on to the spacecraft on Earth, two people were required to lift it. One person was able to lift the same piece of equipment in the space station.
Explain why one person was able to lift the equipment in the space station. (1)

Total Marks 47