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"A Voyage to Space: China's Manned Space Expedition" Special Exhibition Activity Sheet

(Secondary Level – Answer Key)

Since its inception, China's Manned Space Program has made remarkable strides in a number of manned spaceflights, in-orbit astronaut stays and the construction of a space station. This exhibition showcases the journey of astronauts from training to their missions aboard the Tiangong Space Station. It also highlights their work and achievements in conducting scientific experiments on the space station and performing extravehicular activities. Let's delve into the fascinating journey of astronauts on "Tiangong"!

Becoming an Astronaut

To prepare for the complex and dangerous tasks performed in the extreme environment of space, astronauts must undergo long-term and rigorous training. Experience astronaut training programmes at the "Becoming an Astronaut" exhibition zone, and answer the questions below.

1) What year marked the official launch of China's Manned Space Program?

Answer: 1992

The digital panel of "Complete Training Log of Astronauts" and text panel of "A Taste of Weightlessness" introduce information on how Chinese astronauts are trained. Fill in the blanks below with the correct answers.

2) Chinese astronauts are required to receive training programmes in four phases. Please list them below:

Basic Training	Aerospace Professional Skills Training
Spaceflight Mission Simulation Training	Reinforcement Training and Mission Preparation

3) Why is it necessary for astronauts to have underwater training in a neutral buoyancy pool? (Refer to the information provided on the text panel and explain it in your own words.)

The water buoyancy in the pool allows astronauts to familiarise themselves with the weightlessness in space.

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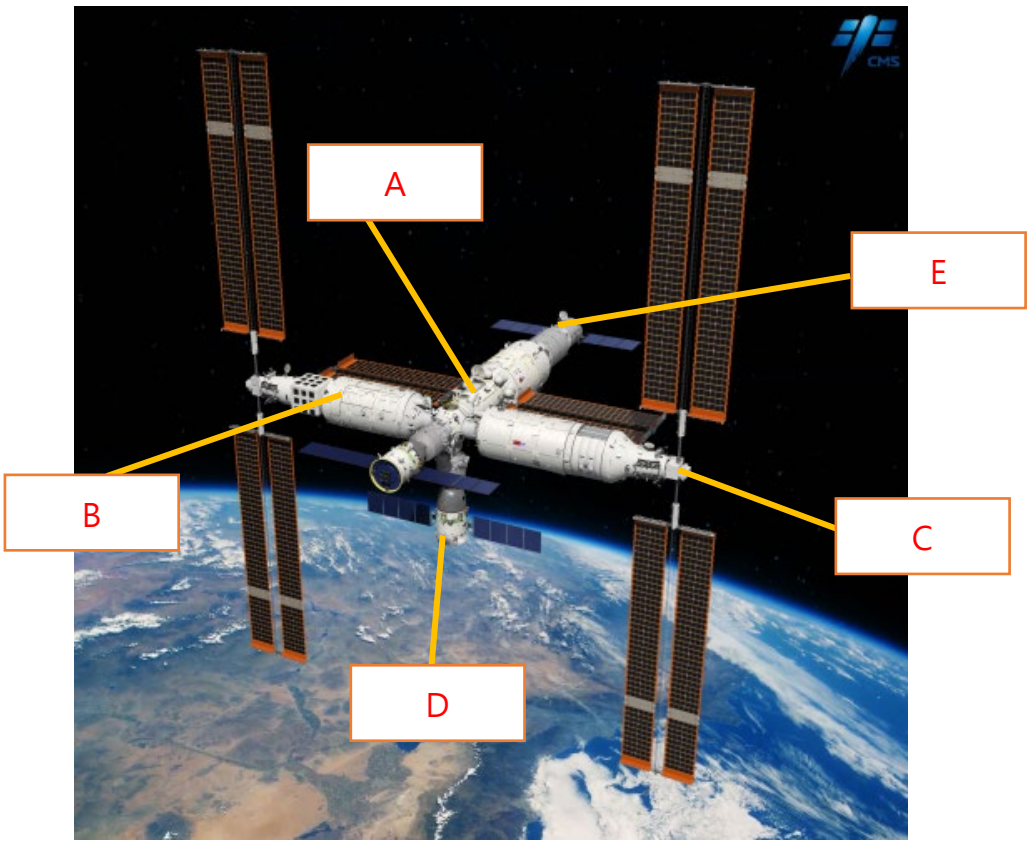
Tiangong Space Station

Operating approximately 400 kilometres above the Earth's surface, the Tiangong Space Station not only serves as a home to the astronauts but also as a space scientific laboratory.

4) The Tiangong Space Station can be flexibly assembled in-orbit like building blocks. Observe the space station model displayed at "Docking with Tiangong" section, then match the name of the modules and spacecraft by putting the corresponding letters into the boxes below.

A) Tianhe Core Module It serves as the control and management centre of the space station, and the main living space for astronauts	**B) Wentian Lab Module** It equips with multiple scientific experiment racks, and features the main exit-entry point for astronauts to perform extravehicular activities	**C) Mengtian Lab Module** It consists of multiple scientific experiment racks and features exposure payload platforms that enable the exposure of experimental specimens to the space environment
D) Shenzhou Manned Spacecraft It can accommodate and carry three astronauts to and from the space station	**E) Tianzhou Cargo Spacecraft** It is an unmanned spacecraft which delivers supplies, such as food, maintenance parts, and propellants to the space station	



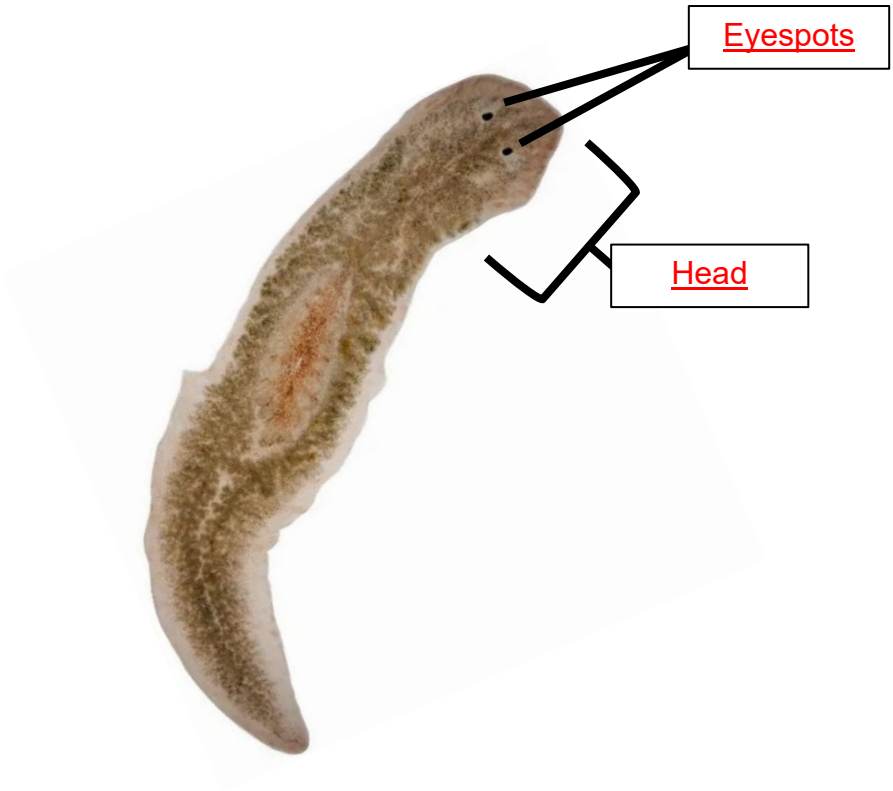
*__Extended Thinking:__ What is the purpose of installing multiple sets of large solar panels to the Tiangong Space Station?

[Reference: Solar panels (also known as solar wings) utilise sunlight to generate electricity and serve as the main source of energy for the space station. Solar panels can automatically adjust their positions to track the direction of sunlight, ensuring an optimal light-receiving angle.]

5) Go explore the "Infinity and Beyond" exhibition zone to learn about the planarian experiment in space, then complete the following questions.

a) Why did the scientists conduct the planarian experiment in space?
To understand how space conditions affect repair abilities of organisms.

b) Use the microscope to observe the planarian specimen. Then, refer to the panel text and fill in the boxes below with the body parts of the planarian.



6) Go explore the "Tiangong Aquarium" exhibition zone to learn about the zebrafish experiment in space, and complete the following questions.

a) Zebrafish were sent to the Tiangong Space Station by the Shenzhou-18 and Shenzhou-20 spacecraft for research. They share over 70 % genetic similarity with humans, making them widely used in biomedical research.

b) Why were the zebrafish being raised together with hornworts (aquatic plants) in a specially designed "space aquarium".

Hornworts can perform photosynthesis under lighting to provide oxygen to zebrafish. The plants also absorb the carbon dioxide produced by zebrafish during respiration, as well as purifying the water by absorbing and breaking down the zebrafish excrement.

c) Humans experience a disorienting sensation of weightlessness in space. What kinds of abnormal behaviours did the zebrafish exhibit when they swam in the weightless environment of space?

Dorsal and ventral inverted swimming, rotational movement, and circling.

7) Go explore the “Horticulture in Tiangong" exhibition zone to learn how astronauts grow fruits and vegetables in space. Then complete the following questions.

a) Which of the following is/are the reason(s) for astronauts growing fruits and vegetables aboard the Tiangong Space Station?

A) As food

B) For air purification

C) For relieving astronauts' psychological stress

D) All of the above

Answer: D

b) Plants will lose their direction in the weightless environment in space, making their stems and roots to grow in all directions. How did scientists guide the plants to grow in an orderly manner on the space station?

The scientists precisely adjusted the light source positions and water supply, and used specially designed cultivation systems.

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***Extended Thinking:** Why is planting fruits and vegetables in space important for long-term space missions?

[Reference: Sustainable food supply; helps develop life support systems or closed ecological systems — plants absorb carbon dioxide for photosynthesis, produce oxygen, and recycle the water resources through transpiration.

Spacewalks

8) To cope with the harsh environment of space, Chinese astronauts will put on the "Feitian" extravehicular spacesuits when stepping out of the space station for extravehicular missions. Try look for the functions of different parts of the extravehicular spacesuit from the text panel.

Backpack
It consists of a portable environment control and life support system

Helmet Visor
It reflects sunlight effectively and protects the astronaut's eyes

Electrical Control Panel
It is equipped with a digital display, a pressure gauge and switches of various devices

The Mirror on the Gloves
It allows astronaut to observe blind spots

Safety Tether
It can ensure extravehicular activities are performed safetly

Electrical Umbilical
It provides electrical power and communication in the preparation phase of extravehicular activities

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9) Reflection and Summary

Complete the following reflections based on your visit and learning experience today:

1. My most interesting finding of today:

_____

2. Two aspects of space experiment that I think are significant to humans:

_____ _____

[Reference answer: Promoting technological advancement; improving life on Earth, preparing for future long-term human residence in space station; and other reasonable answers]

3. New insights I gained about the work of Chinese astronauts:

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