



KNOX
GRAMMAR
SCHOOL

REGIONAL

DA VINCI DECATHLON 2023

CELEBRATING THE ACADEMIC GIFTS OF STUDENTS
IN YEARS 9 & 10



SCIENCE

TEAM NUMBER _____

1	2	3	4	Total	Rank
/15	/15	/15	/15	/60	

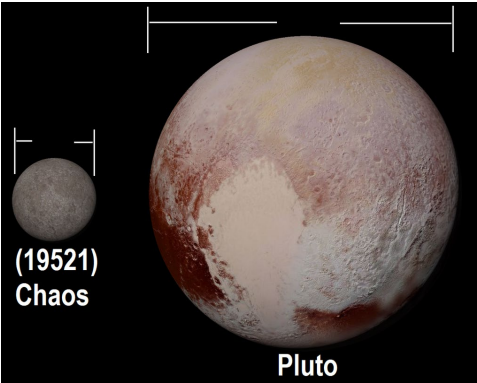
QUESTION ONE

STARGAZING

15 MARKS

If you were to somehow venture out into our solar system, past the orbits of all of the other planets, you would find an object called **19521 Chaos**. This first question is devoted to that object.

1. The picture on the right shows the size of 19521 Chaos relative to Pluto. Given that the diameter of Earth is 12,742km, can you estimate the **diameter** of 19521 Chaos to the nearest 100km? **2 MARKS**



2. 19521 Chaos will reach its **perihelion** around Christmas of 2033. What is a perihelion? **2 MARKS**

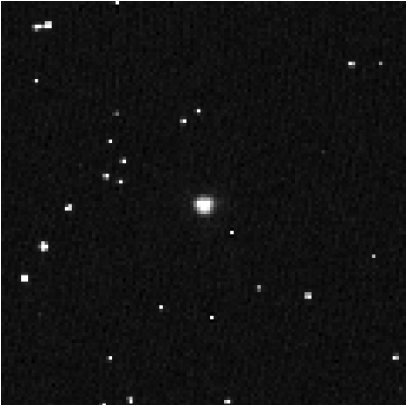
3. 19521 is a **cubewano** – an object that is in our solar system, orbiting around the sun, but not within the orbit of any planet (unlike, for example, the moon). The other key feature of a cubewano, therefore, is that it orbits the sun beyond the orbit of which planet? **1 MARK**

4. The location of 19521 Chaos is symbolic of the concept of ‘chaos’ in Ancient Greek **mythology**, hence the object’s name. Given this information, briefly describe the Ancient Greek mythological concept of ‘chaos’. **2 MARKS**

5. Astronomical bodies are given unique designated **adjectives**. The adjective for 19521 Chaos is: **1 MARK**

- Chaotic
- Chaotian
- Chaotese

6. **True or false:** the picture on the right is 19521 Chaos, taken by the Hubble Space Telescope. **1 MARK**



7. The aforementioned concept of a perihelion, together with inclination, observation arc, mean motion, and various other things, are all forms of what? **1 MARK**

- Atmosphere characteristics
- Designations
- Orbital characteristics
- Physical characteristics

8. The closest that 19521 Chaos will ever be to Earth is approximately **40 AUs**. What does AU stand for? **1 MARK**

9. What does the **length** of an AU equate to? **1 MARK**

- Length of Earth's orbit around the sun
- Diameter of the sun
- How far light can travel in a minute
- Distance from Earth to the sun

10. 19521 Chaos could have been a **moon** had it found itself in the orbit of another planet. Which planets in our solar system have no moons? **2 MARKS**

11. The name of 19521 Chaos, like many objects in our solar system, was allocated by the **Minor Planet Center**. The Minor Planet Center is part of which major American museum and research institution located in Washington, DC? **1 MARK**

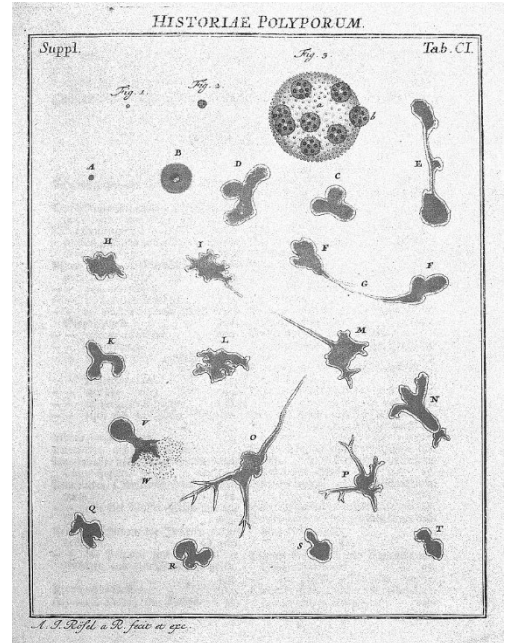


QUESTION TWO

UNDER THE MICROSCOPE

15 MARKS

We move now from the immensity of our solar system to the microscopic world of **amoeba**. Amoeba are **single-celled organisms**, and one particular genus of amoeba, unique because it can have more than one nucleus (indeed, up to a thousand!), is the **chaos** genus. This question focuses on these fascinating organisms.



1. Complete the scientific classification table below for the *chaos* genus. **3 MARKS**

_____ : Eukaryota
Phylum: Amoebozoa
 _____ : Tubulinea
Order: Euamoebida
 _____ : Amoebidae
Genus: Chaos

2. The picture above shows that amoeba such as those in the *chaos* genus have many **arm-like projections** that protrude outwards. These are constantly morphing so that an amoeba can move and feed. The singular noun for these projections is: **1 MARK**

- Pseudopod
- Ungulate
- Vacuole
- Proboscis

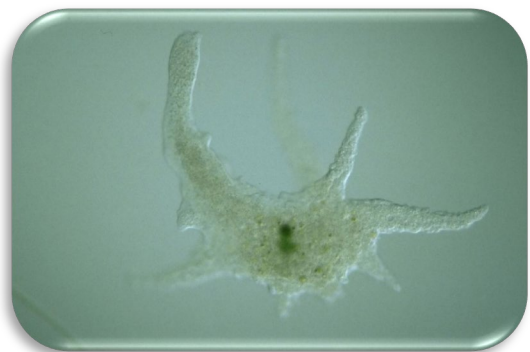
3. Species in the *chaos* genus are, like humans, **heterotrophs**, as opposed to **autotrophs**. Define these two terms. **2 MARKS**

4. An organism in the *chaos* genus is comprised of various parts. Using the answer bank below, can you match the terms to their definitions? **5 MARKS**

- a. The inner fluid of the organism: _____
- b. The organic wall protecting the organism from the outside environment: _____
- c. The powerhouse of the cell: _____
- d. The non-granulated layer of the organism, used to transport matter from the outside environment into the inner fluid: _____
- e. Consists of both (a) and (d): _____

Answer Bank for Question 4: ectoplasm, endoplasm, cytoplasm, membrane, mitochondria.

5. Organisms in the *chaos* genus are a few millimetres in size, and as such are classified as 'giant amoeba'. Most amoeba are only measured in μm . What does μm represent? **1 MARK**



6. As noted above, the *chaos* genus consists of single-celled organisms. Is it **true or false** that the largest known single-celled organisms in the world can be as big as several metres long? **1 MARK**

7. Also as noted above, organisms in the *chaos* genus are **multinucleate** – that is, they have multiple nuclei. What term is the opposite of multinucleate? **1 MARK**

8. One species in the genus is *chaos illinoisense*. Who is the most recent US President to have been Governor of the State after which this species is named? **1 MARK**

QUESTION THREE

A PERIOD OF INSTABILITY

15 MARKS

Harvard University has compiled and published a list of '**Potentially Unstable Chemicals**'. You could say that some of these chemicals might act **chaotically** if exposed to the elements. This question challenges you to complete the table below by identifying either the names or chemical formulae of some of these unstable chemicals.

TITLE	TITLE
	NaH
Titanium tetrachloride	
Diborane	
	Fe(CO) ₅
Dicobalt octacarbonyl	
	AgClO ₂
Boron trifluoride	
	POCl ₃
	LiAlH ₄
Tin(IV) chloride	
	RNa
	S ₂ Cl ₂
Sulfuryl chloride	
Zirconium tetrachloride	
	Hg(ClO ₂) ₂



QUESTION FOUR

ON SHAKY GROUND

15 MARKS

A common term in the field of **astrogeology** is that of the ‘**chaos terrain**’ – and while you might not have heard of this before, you have very likely seen pictures of chaos terrains as they are dominant features of planets such as Mars and Jupiter, as well as our moon.

In essence, a chaos terrain is a landscape with many different **landscape features** enmeshed together, usually as a result of a number of simultaneous and powerful **geological events**. This question will provide you with a number of photographic and cartographic examples, which you must use to answer the questions below.

1. Scientists have developed a theory for how chaos terrains generally form. If you were to simplify this down to individual words, in chronological order, they would be: meteor, water, ice, magma, flood. Using this information, briefly explain how chaos terrains are thought to be created. 4 MARKS

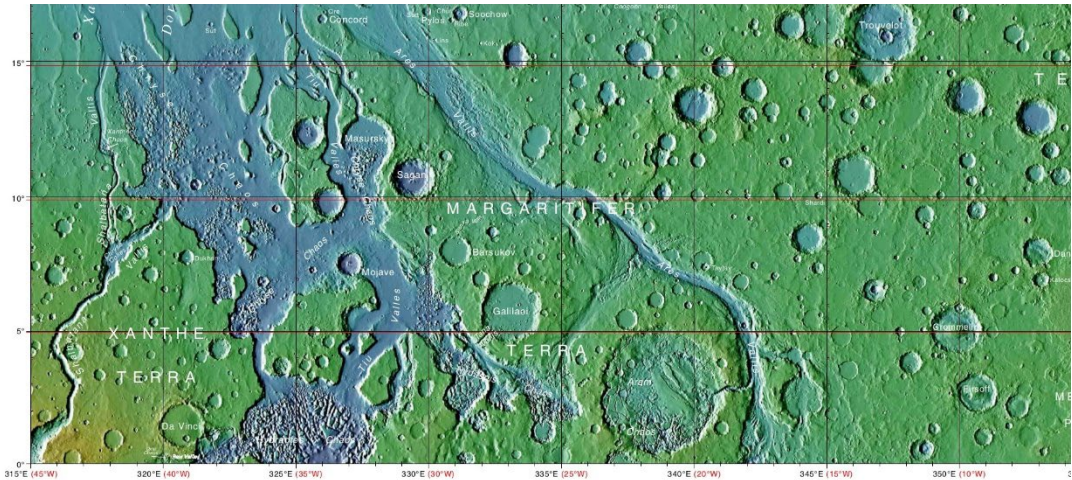


Image: topography map of chaos terrain on Mars

2. List the geological features commonly found in chaos terrains, using the scrambled or incomplete answers provided below. **8 MARKS**

UNSED	
_A__ON	
ASEM	
B_T_E	
GRIDE	
C_A__R	
SPLINA	
_A_LE_	

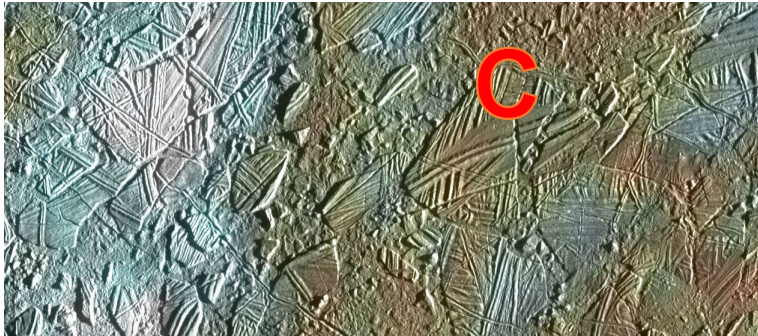
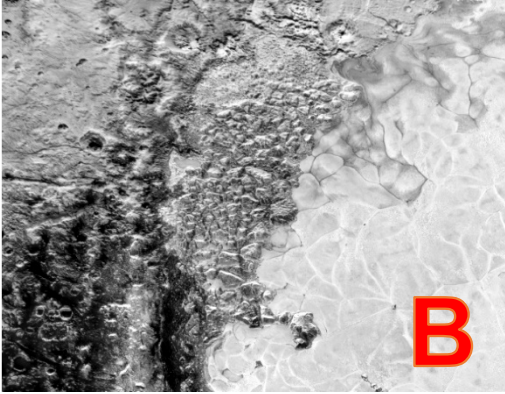
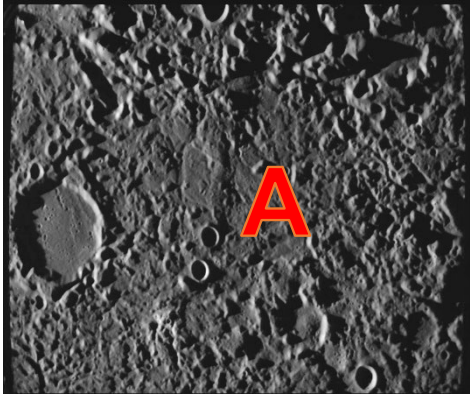
3. Match the three pictures to their locations. **3 MARKS**

Picture A: _____

Picture B: _____

Picture C: _____

Answer bank: Mercury, Europa (a moon of Jupiter), Pluto



END OF PAPER