VERSION B Solution **VERSION B**

1. Why are there so few visible craters on the Earth?

A) Erosion and resurfacing erases them.
B) The Moon protects us from most meteorites.
C) Fewer things hit the Earth because our atmosphere protects us.
D) The Earth just has not been hit much. Good fortune smiles upon us.
E) The Earth formed long after the other planets, and so, as a whole, is much younger than the other planets.

2. What is the approximate age of the surface in image 1D? (Assume the image is roughly the size of Missouri.)

A) Less than a few million years old. There are no craters.
B) 200-500 million years old. There are some craters present, but not too many.
C) 2-3 billion years old. There are plenty of craters, but also smooth areas (so not saturated).
C) 4-4.5 billion years old. The surface is saturated, there are no smooth areas and many craters overlap.
D) More than 10 billion years old.

3. What is the structure of Uranus and Neptune?

A) Thin atmosphere over rocky crust, mantle, and core.
B) Mostly H atmosphere over liquid/ice mantle of water/ammonia/methane over a rocky core.
C) Mostly H atmosphere which thickens to liquid, then becomes metallic H, over a rocky core.
D) Ice crust over a water ocean over a rocky mantle and core.
E) None of the above.

4. What are the pink arrows pointing to in Image 1C?

A) Craters.
B) Volcanoes.
C) Rivers.
D) Sand dunes.
E) A seahorse.

5. What is the best estimate for the age of our solar system?

A) 3,000 years old.
B) 200-500 million years old.
C) 4.5 billion years old.
D) 12 billion years old.
E) There is no estimated age, as there is no way to know.

6. The surface in Image 2B is most likely…

A) A solid.
B) A liquid.
C) A gas.
D) None of the above.

7. What type of erosion are the yellow arrows pointing to in Image 1B?

A) Wind erosion.
B) Liquid erosion (river beds, etc).
C) Plate tectonics
D) This is not a solid surface.

8. The goal of science is to …
A) make people feel stupid.
B) understand the world (and Universe).
C) make followers of the populace around us.
D) give mathematicians something to do.
E) make things up so we can fool the public into giving us grant money.

9. What is the approximate age of the surface in image 1A? (Assume the image is roughly the size of Missouri.)
A) Less than a few million years old. There are no craters.
B) 200-500 million years old. There are some craters present, but not too many.
C) Around 2 billion years old. There are plenty of craters to see, but it is younger than the lunar maria.
D) 4-4.5 billion years old. The surface is saturated, or nearly so.
E) More than 10 billion years old.

10. What is the structure of icy moons (warm interior) like Europa and Ganymede?
A) Thin atmosphere over rocky crust, mantle, and core.
B) Mostly H atmosphere over liquid/ice mantle of water/ammonia/methane over a rocky core.
C) Mostly H atmosphere which thickens to liquid, then becomes metallic H, over a rocky core.
D) Ice crust over a water ocean over a rocky mantle and core.
E) None of the above.

11. Which factor is <u>not</u> important to determine if an object has an atmosphere and its composition?
A) The temperature.
B) The mass of the gas particles.
C) The mass (escape velocity) of the object.
D) How many moons the object has.

12. If I see an object with active volcanoes, what else can I assume?
A) It is populated with aliens that use it sacrificially.
B) It is a large, gassy world.
C) It has many moons.
D) It has an atmosphere.
E) It has lakes.

13. In Image 1D, the yellow arrow is pointing to …
A) a crater.
B) a mountain range.
C) a dry river bed.
D) sand dunes.
E) All of the above.

14. Our solar system can best be described as...
A) a place where change is always occurring, but usually very slowly.
B) a place where nothing changes.
C) a system dominated by the Earth, with everything else being much smaller.
D) a place we know well, since we have sent people to all 8 planets.
E) a mystery, since we know so little about anything, including Earth.

15. Because the object in Image 2A is not round, what else do I know?
A) It is made mostly of gas.
B) It is made mostly of water.
C) It will fall into the Sun.
D) It is not especially massive (less so than Missouri).
E) It must be a moon of Jupiter..

16. What is at the center of our solar system?
A) Jupiter.
B) The Sun.
C) The Earth.
D) The center of our galaxy.
E) Nothing.

17. A planet with a density near 1.0 g/cc is most likely…
A) A Jovian-like planet.
B) A Terrestrial-like planet.
C) Like an icy moon
D) None of the above.

18. The surface in Image 2B is mostly like…
A) A solid.
B) A liquid.
C) A gas.
D) All of the above.
E) None of the above.

19. What do we use to infer the age of a planet or moon's surface (other than the Earth and the Moon)?
A) Radiometric dating.
B) The numbers of craters present.
C) Dates in text books.
D) The heights of the tallest trees.
E) All of the above.

20. What is the structure of the terrestrial planets?
A) Thin atmosphere over rocky crust, mantle, and core.
B) Mostly H atmosphere over liquid/ice mantle of water/ammonia/methane over a rocky core.
C) Mostly H atmosphere which thickens to liquid, then becomes metallic H, over a rocky core.
D) Ice crust over a water ocean over a rocky mantle and core.
E) None of the above.

Short answer questions. 4 points each. Spelling and grammar count.

21. Which object is likely more massive, object 2C or 2D? *Describe* why you think that? (The images are not to scale.)
2C as it appears to be a gas planet and 2D appears to be a terrestrial planet. All of our gas planets are more massive than the terrestrial ones.

22. Put the images in Image 1 in order from <u>oldest</u> to <u>youngest</u>.

A (saturated with craters) , D, B, C (no craters)

23. In 2 short sentences, describe the object in Image 2A.
Think bulk, not details. Should include shape, composition (many/few), age, solid/liquid/gas: Not hugely massive (not round) shades of the same color, so likely a single composition and has well-defined features so it's a solid. It appears to have no atmosphere and is very heavily cratered so probably 4 billion years old.

24. *Briefly <u>Describe</u>* 2 erosion processes indicated by Image 1C, or write "no erosion".
Volcanoes are the obvious one, which recover ground.
The surrounding water is another obvious one as it implies rain, and possibly ocean currents.

25. *Briefly <u>Describe</u>* 3 observations for Image 2D.
Lots of possibilities: e.g. smooth area looks like liquid. Well-defined areas looks like a solid. Multiple colors indicate multiple compositions, round so it's massive, etc.