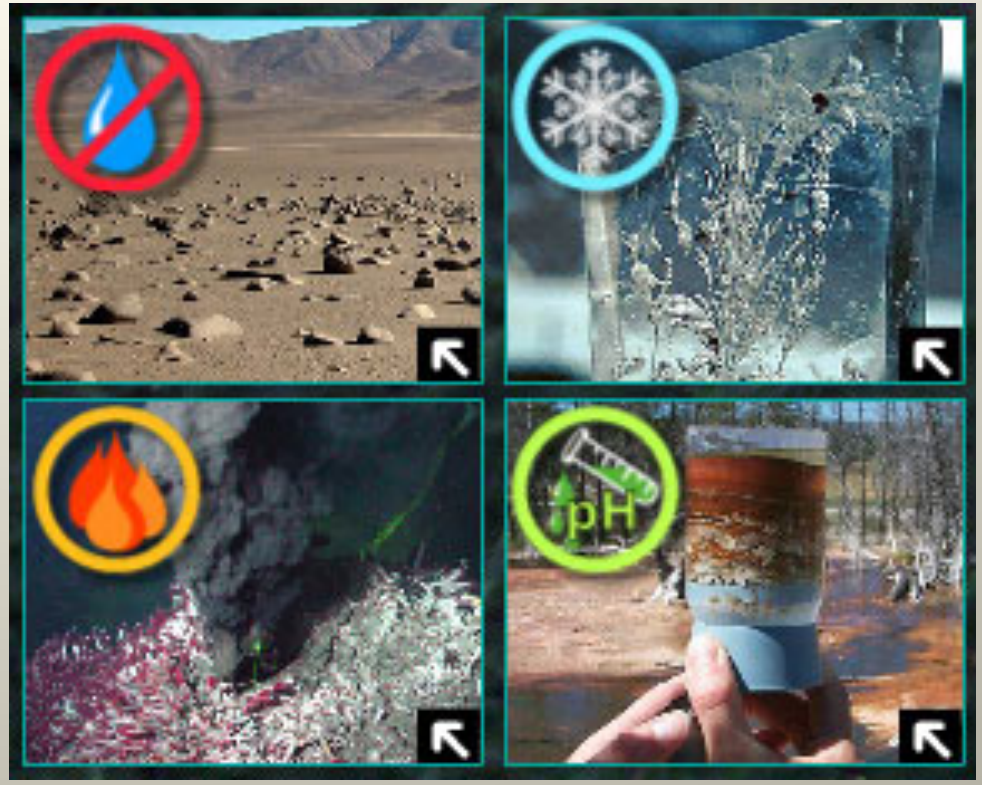
Welcome to Class 10: Life on Earth II

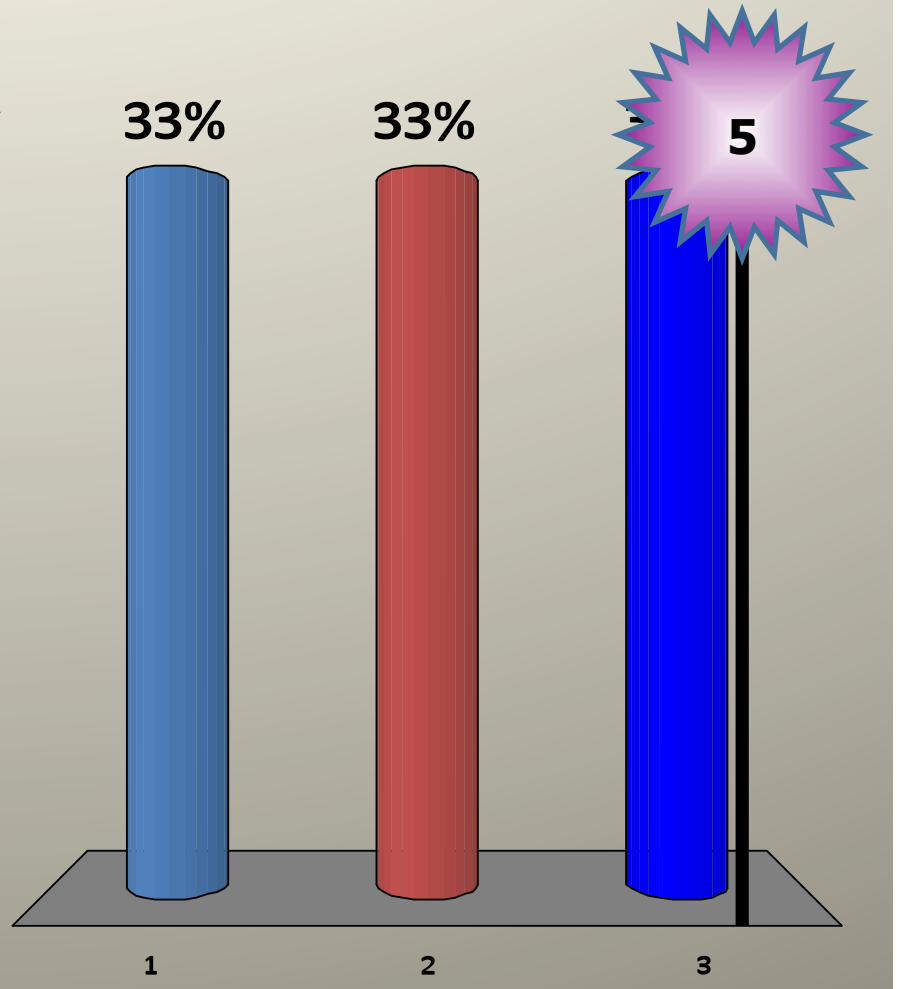


The importance of mutation in Darwin's theory to explain evolution.

What is too extreme for life to *thrive* in?

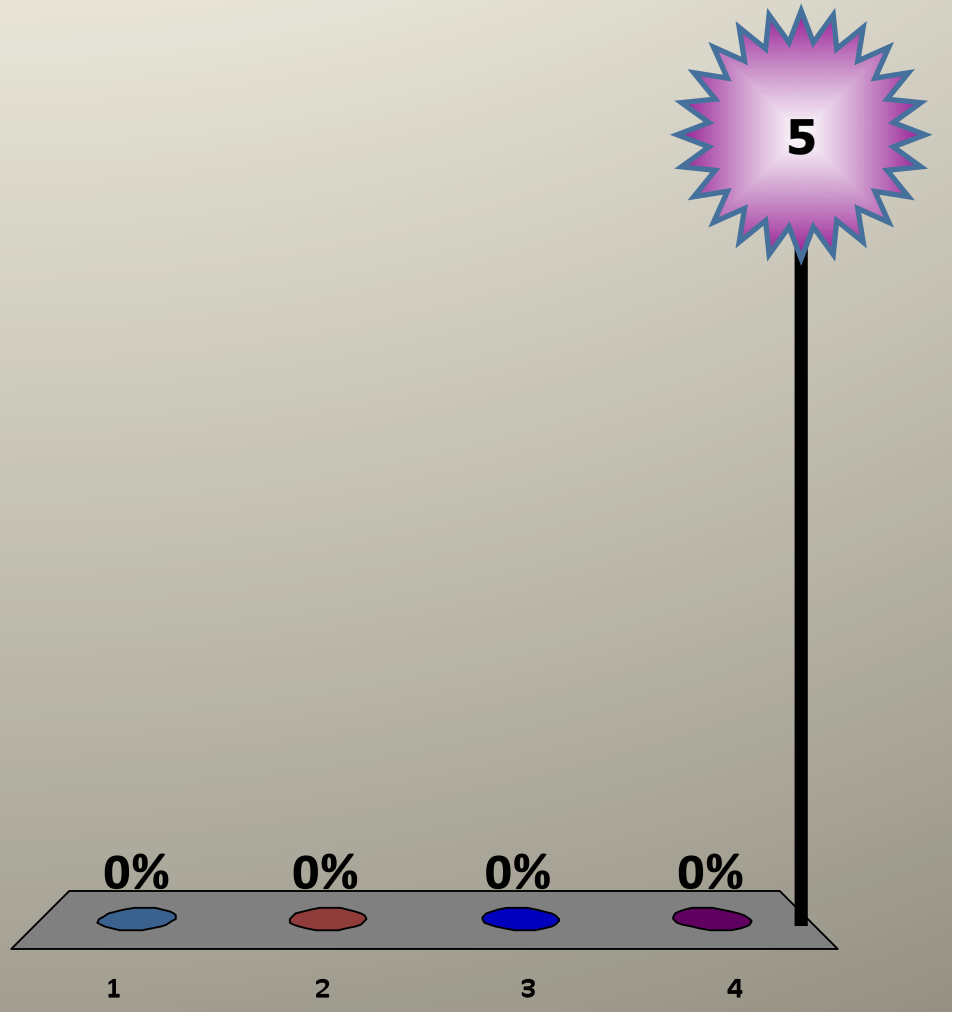
Which of today's learning objective seems most difficult?

1. Auto/Heterotrophs,Chemo/ Photo trophs
2. Gene mutation, how it occurs, why its important for evolution.
3. The extreme conditions life is found on Earth, implications for ET life.



What two basic things do all cells need to **function**?

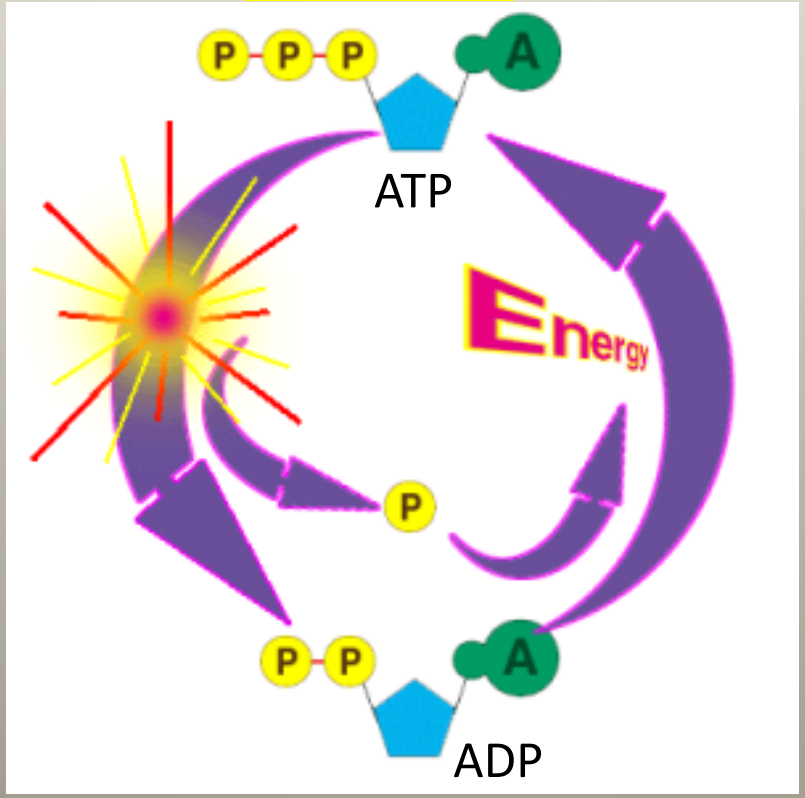
1. Nucleus and cell wall
2. Air and water
3. Energy and raw materials
4. Evolution and adaptation.



ATP = Adenosine Tri-Phosphate
ADP = Adenosine Di-Phosphate

ATP is like an energy packet

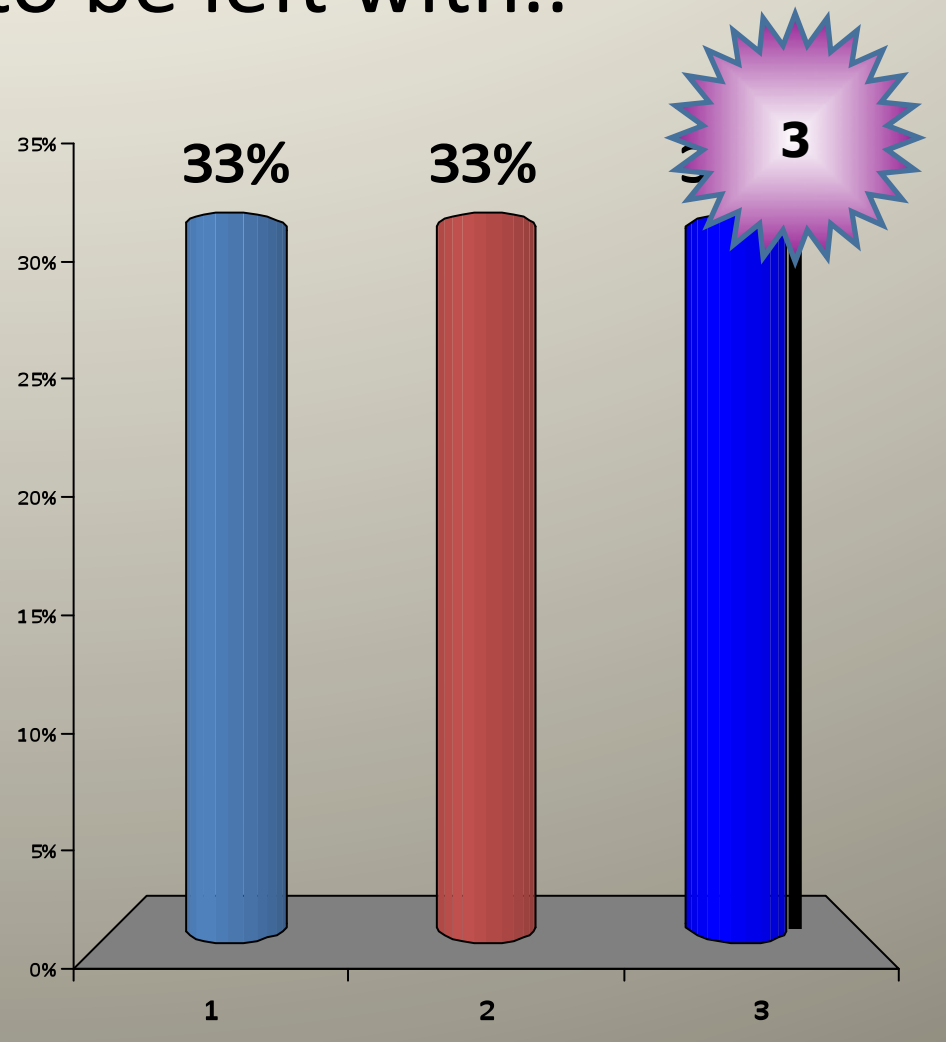
Fuel released for cell functions here



Energy is input here (storage)

After a heavy work out at the gym, would you expect your body to be left with..

1. More ADP than ATP.
2. More ATP than ADP
3. No change in relative levels.



ATP in YOUR body (from Wikipedia)

- The total quantity of ATP in the human body is about 0.1 mole. The majority of ATP is generated from ADP.
- At any given time, the total amount of ATP + ADP remains fairly constant.
- The energy used by human cells requires the hydrolysis of 100 to 150 moles of ATP daily which is around 50 to 75 kg.
- This means that each ATP molecule is recycled 1000 to 1500 times during a single day (100 / 0.1 = 1000).
- Typically, a human will use up their body weight of ATP over the course of the day.

Match the word with the definition

1. Photo heterotroph
2. Chemo heterotroph
3. Photo autotroph
4. Chemo autotroph

a) Energy: Sunlight, Carbon: CO_2

b) Energy: Sunlight, Carbon: Organics

c) Energy: Inorganics, Carbon: CO_2

d) Energy: Organics, Carbon: Organics

Source of carbon: Autotroph = CO_2, Heterotroph = Organics

Source of energy: Photo = Sunlight, Chemo = Chemicals

What kind of ‘troph’ are humans?

1. Photo autotroph
2. Chemo autotroph
3. Photo heterotroph
4. Chemo heterotroph

Errors in DNA replication and the importance of Mutations to Evolution

In replicating DNA, 1 in a billion bases are copied incorrectly.

DNA has billions of bases. Every replication introduces a few errors. Most errors are 'fixed' internally.

Most remaining mutations are harmful to the organism. However, some beneficial mutations also occur.

Beneficial mutations: give survival or reproductive advantage to an organism. Because it is stored in the DNA, it can be passed to the next generation.

What is a habitable world?

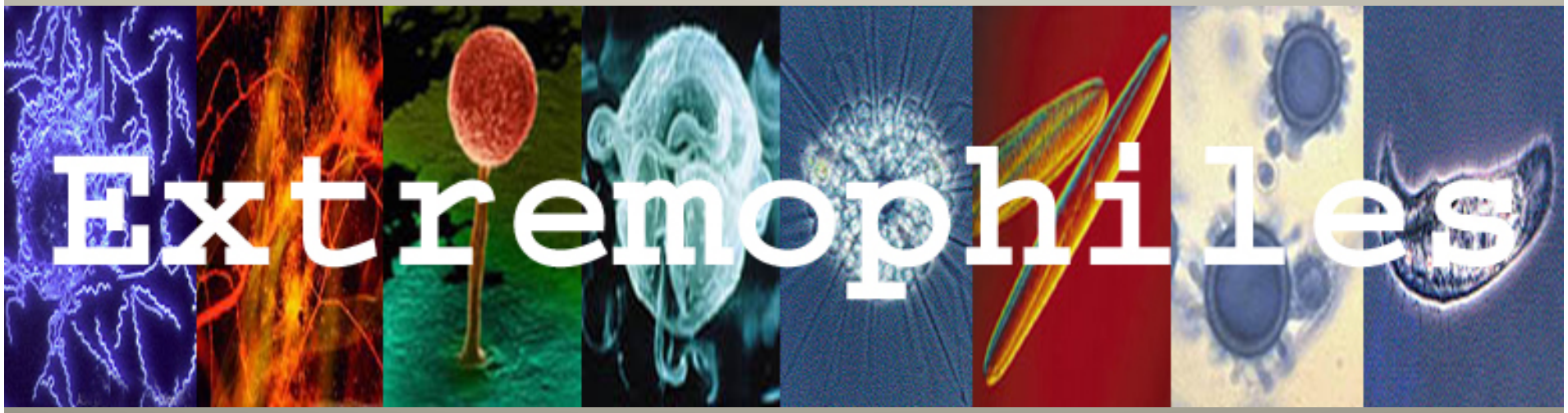
Not too hot.. How hot is that?

Not too cold.. How cold is that?

Protected from radiation.. But at what level?

Not too acidic.. But how acidic is ok?

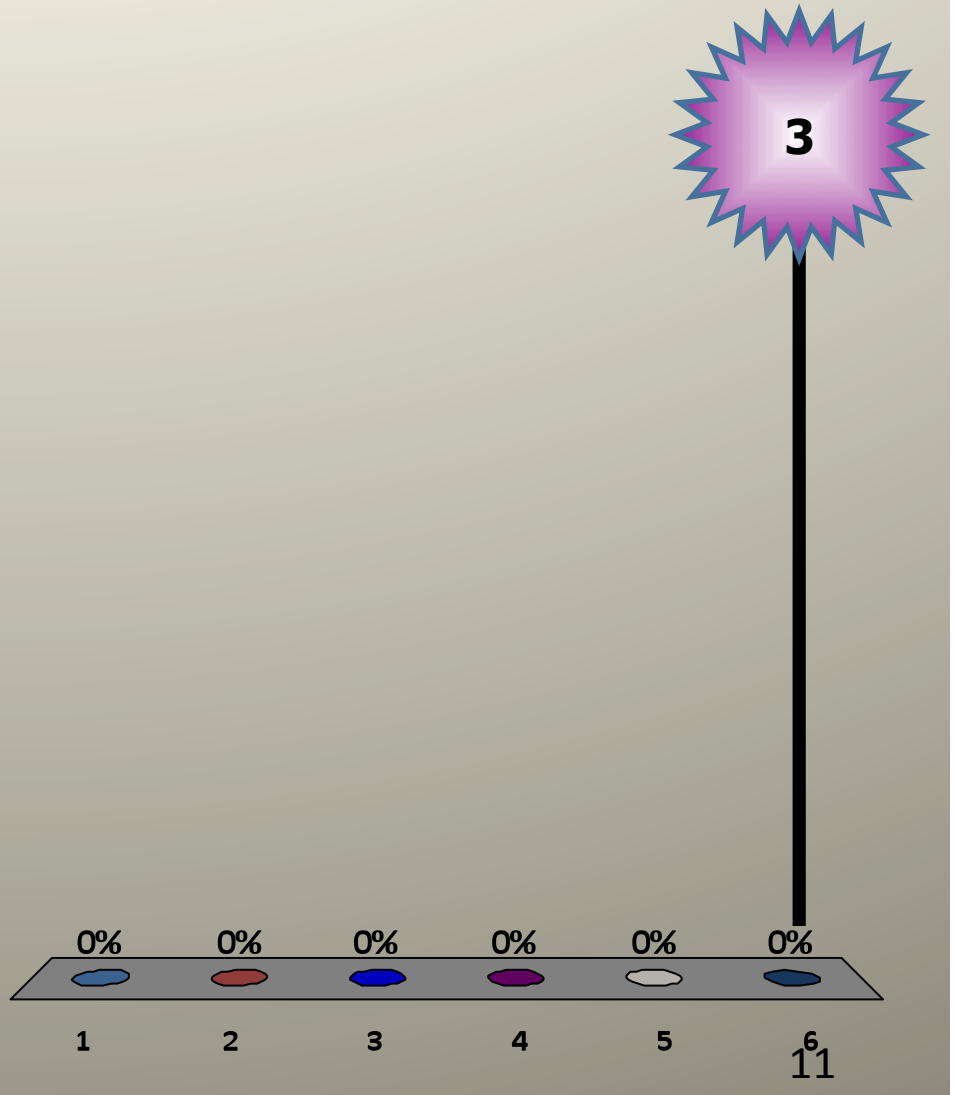
Not at high pressure.. But how high a pressure is ok?



Welcome to the world of…

These micro organisms like heat

1. Thermophile
2. Psychrophile
3. Halophile
4. Barophile
5. Endolith
6. Xerophiles

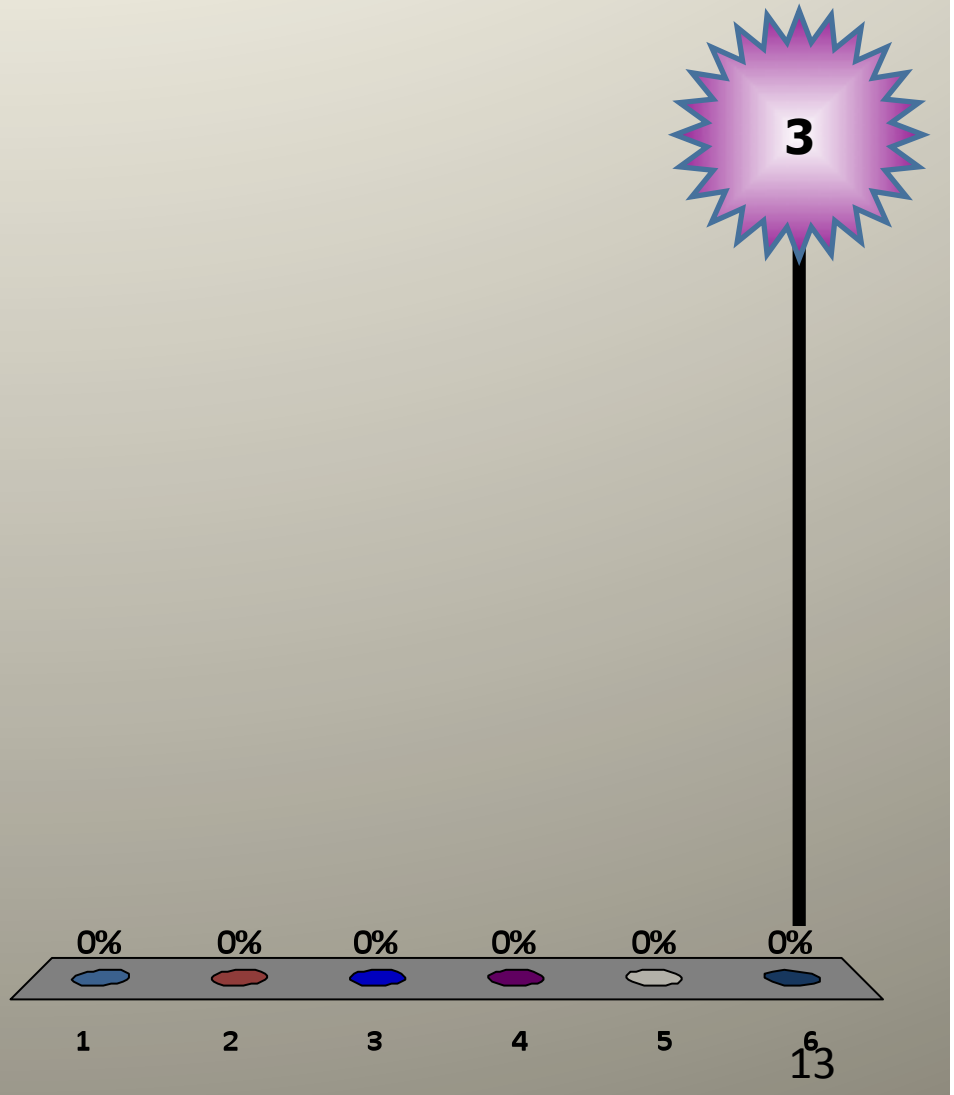


Thermophiles in Hot Pools and Deep Sea spreading centers.

Black Smokers

These micro organisms like cold

1. Thermophile
2. Psychrophile
3. Halophile
4. Barophile
5. Endolith
6. Xerophiles

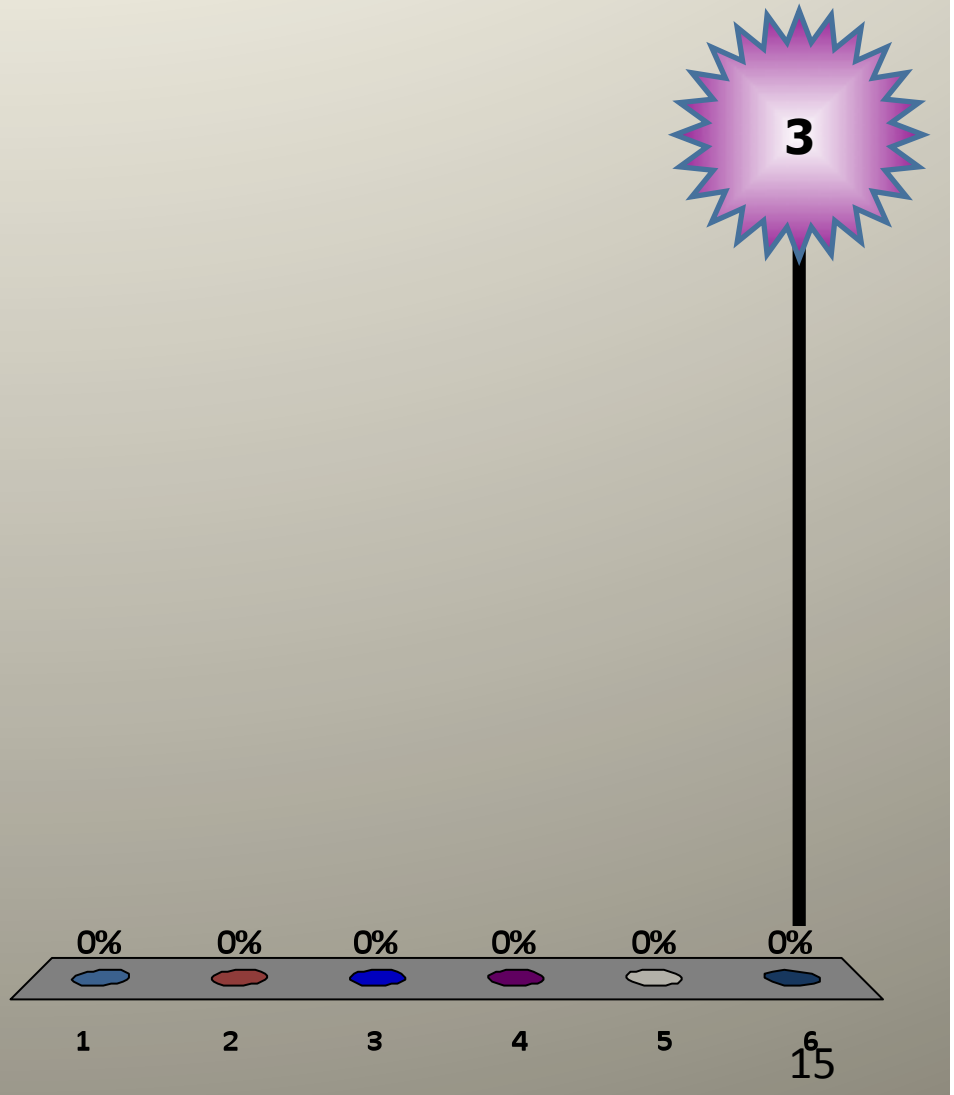


Psychrophiles can survive in ice

Eventually, when it thaws, they come ‘back to life’

These micro organisms live in rock

1. Thermophile
2. Psychrophile
3. Halophile
4. Barophile
5. Endolith
6. Xerophiles



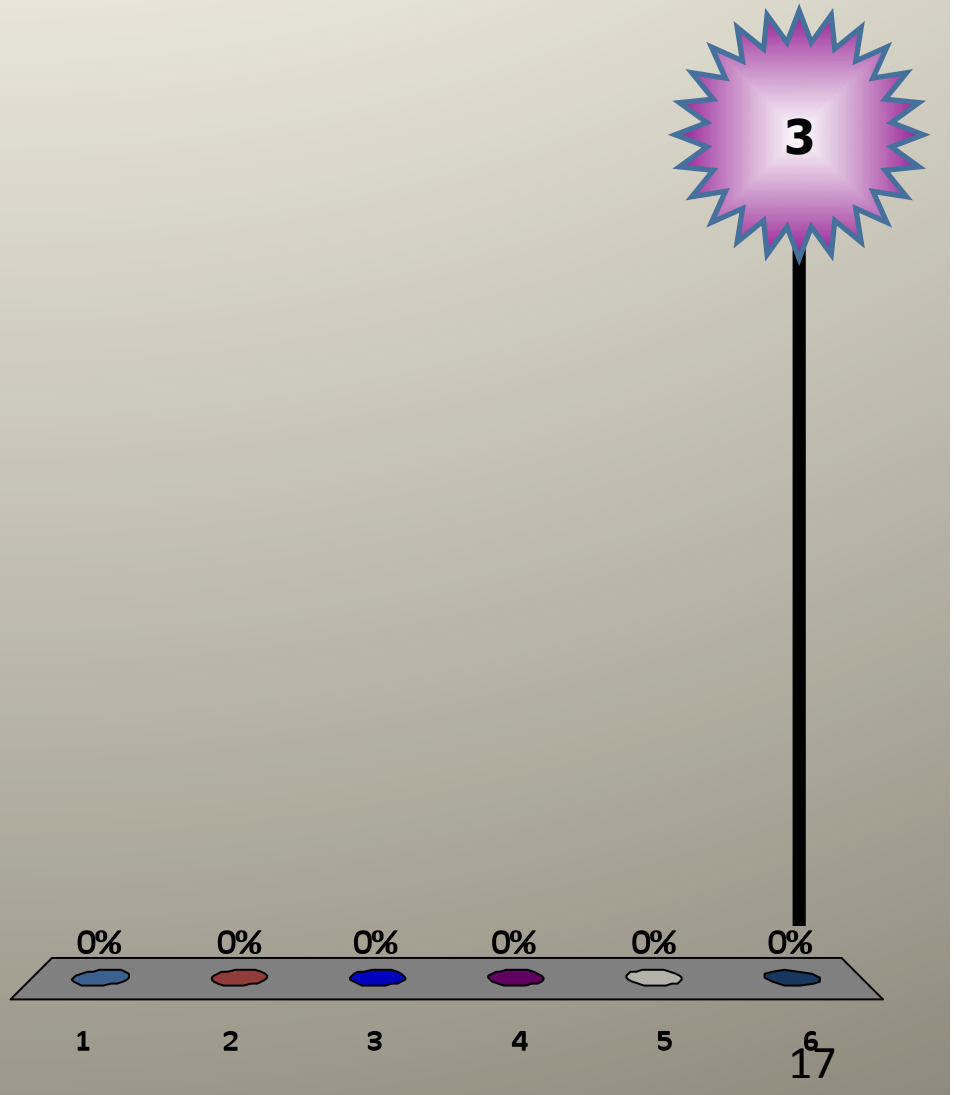
Endoliths live within rock

These sandstone rocks come from the Antarctic.

Light and water can filter into the rock so life can survive.

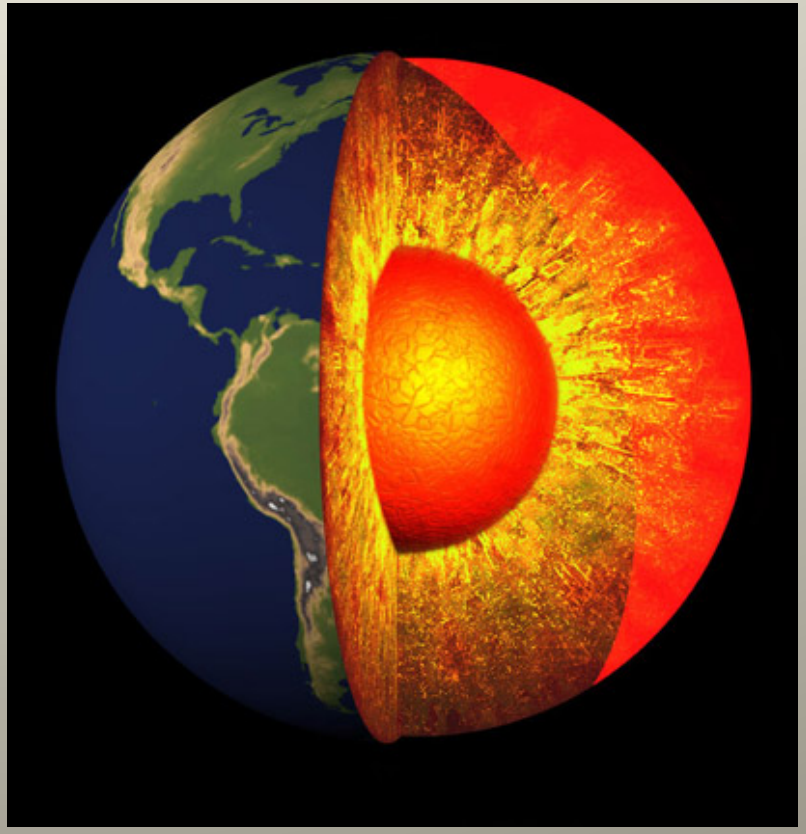
These micro organisms can live at times with little or no water

1. Thermophile
2. Psychrophile
3. Halophile
4. Barophile
5. Endolith
6. Xerophiles



Can you think of someplace on earth where there is NOT life?

Lava?



The inner earth?

Movie Time.. !!

Something to think about..

If life can live in such extreme environments:

What keeps it from surviving on space craft?

What keeps it from traveling on rocks thrown into space?

Might life on Earth have come from a rock from space?

Might life on Earth have been transported to Mars with our rovers?

Can you name two advantages to living in extreme physical environments?

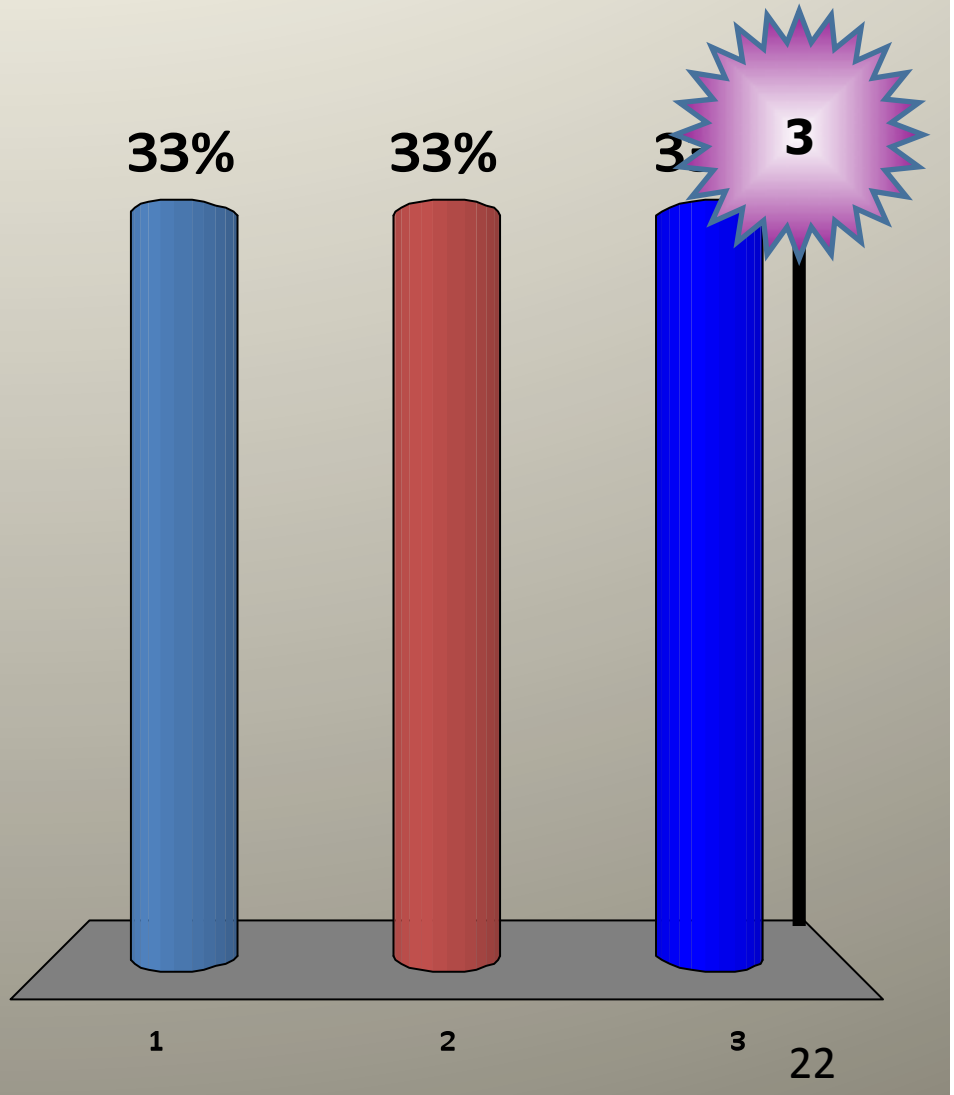
Here are two hints:

Fewer organisms are there to:

1) Eat you (predators are few)
2) Compete for the resources.

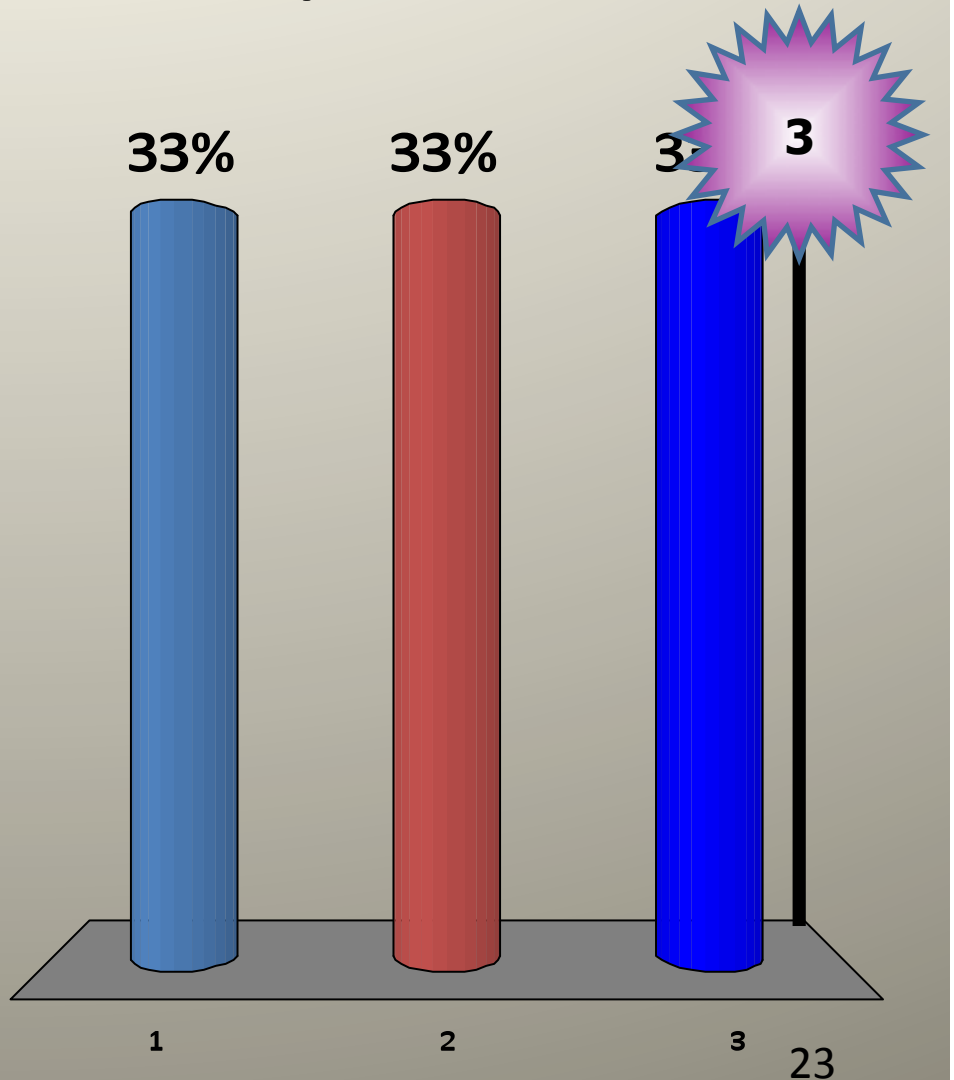
Are extremophiles happy (thriving)?

1. No, they would live better in not so extreme conditions.
2. Yes, they like where they live.
3. No, they would live better in more extreme conditions.



What do extremophiles have to do with the search for life in space?

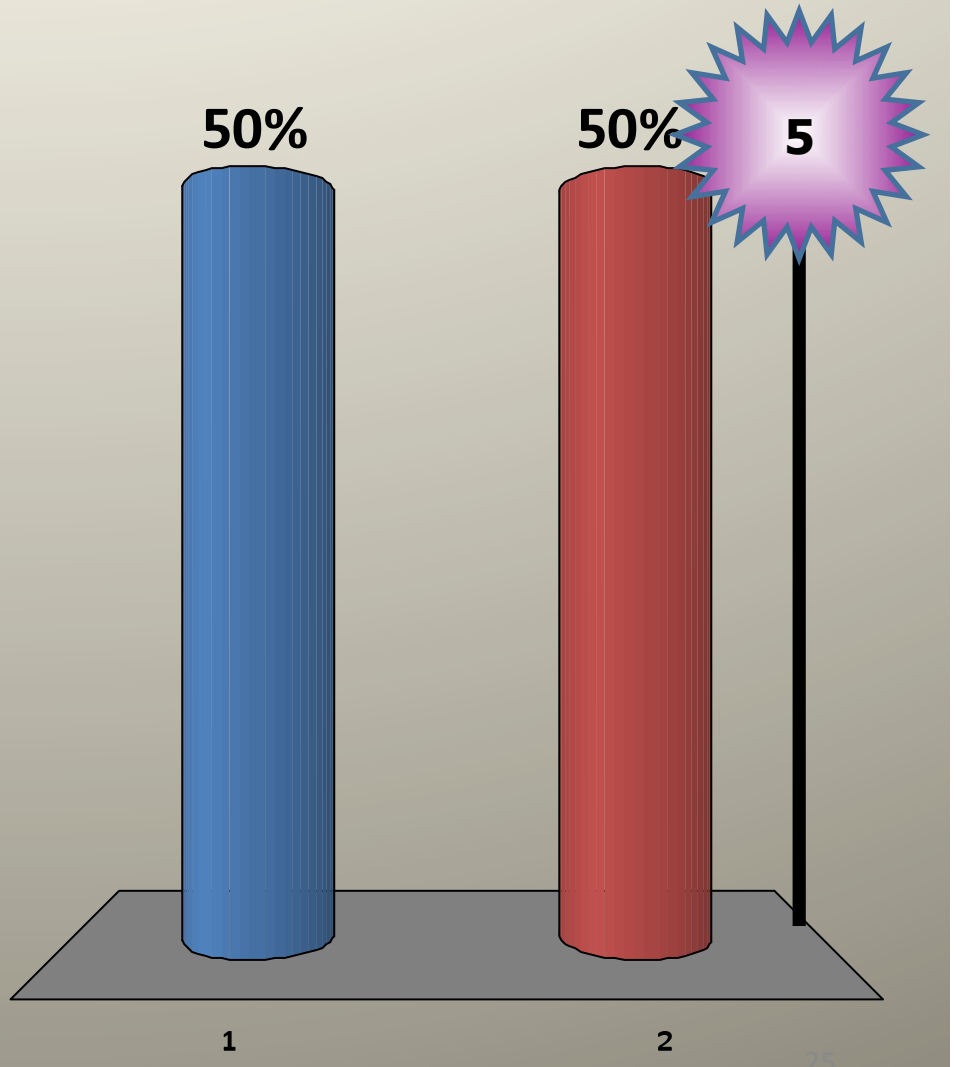
1. It shows ET life should be like that one Earth.
2. Life can thrive in only a very narrow range of conditions.
3. Life can thrive in a much broader range of conditions than we first imagined.



Let’s do the final quiz on today’s material

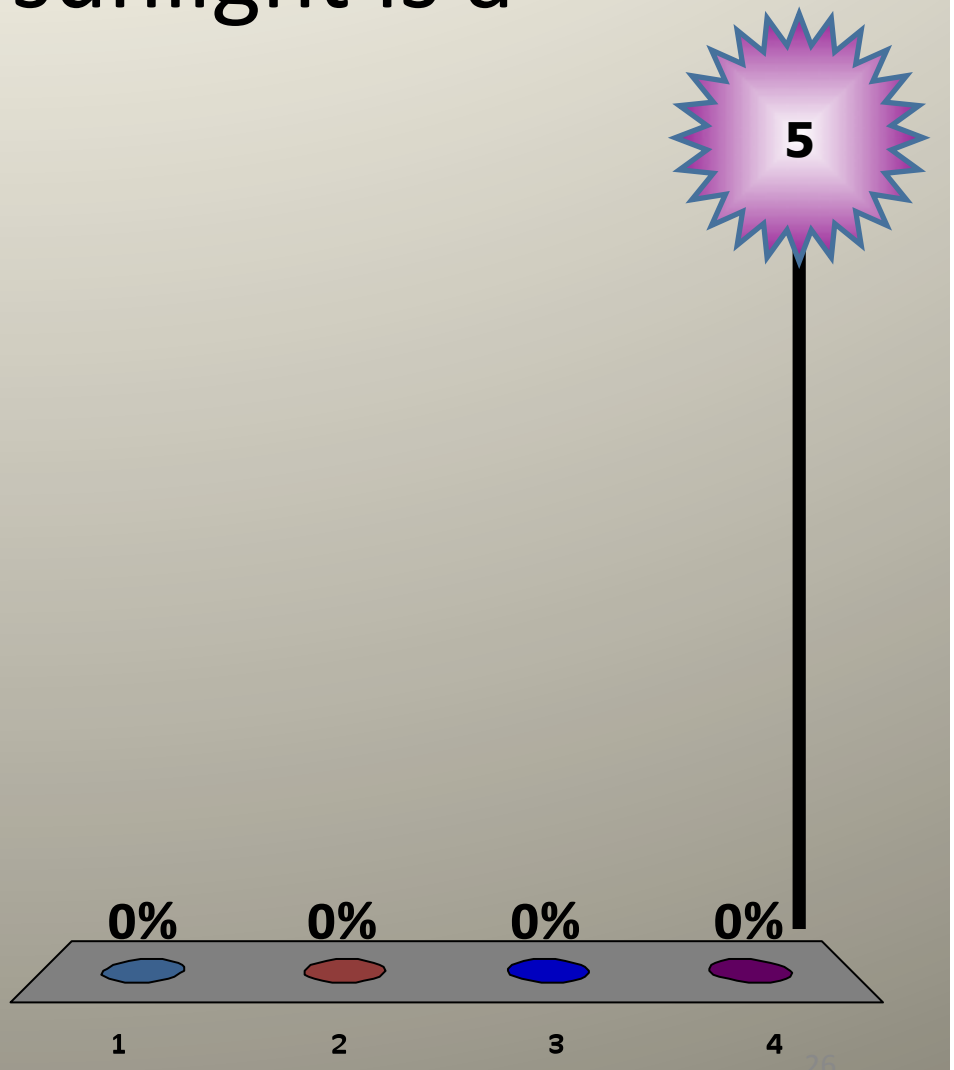
1. When a cell needs energy, it converts

1. ATP into ADP
2. ADP into ATP



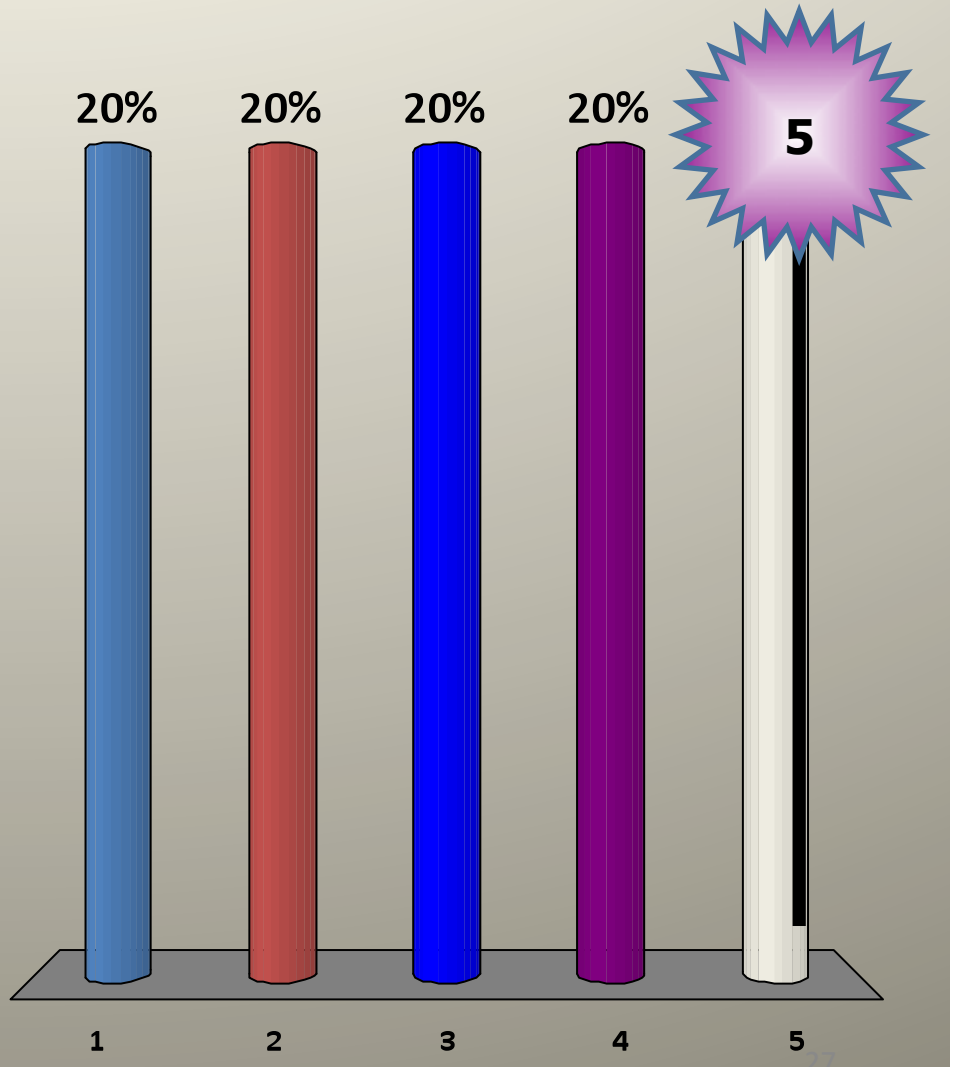
2. A life form which gets its carbon from CO_2 and energy from sunlight is a

1. Photo autotroph
2. Photo heterotroph
3. Chemo heterotroph
4. Chemo autotroph



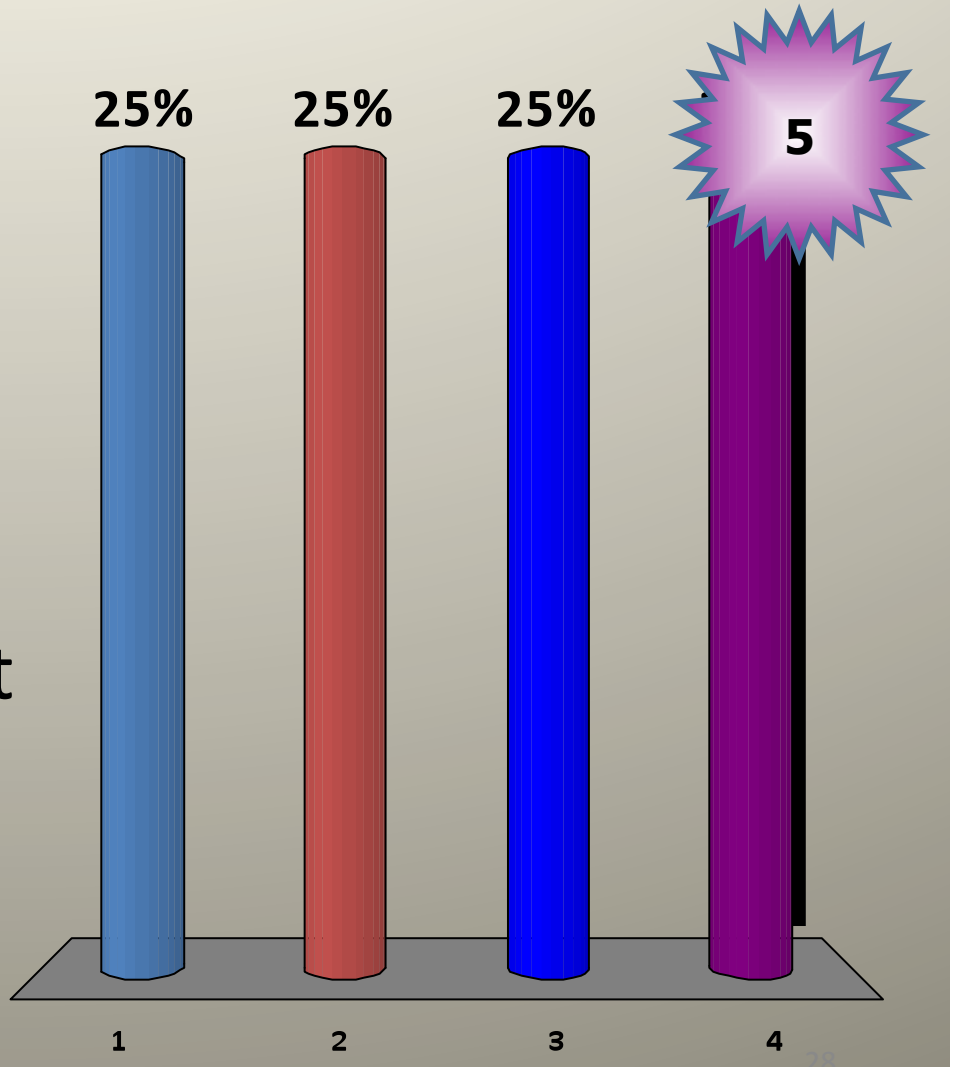
3. DNA mutations are important …

1. for Cell walls
2. As a source of energy
3. For evolution
4. As a source of carbon
5. For making ATP.



4. Which is an advantage of being an extremophile?

1. Live where few other organisms can live.
2. Live where there are more resources.
3. Can more easily adapt to new climates.
4. All of the above.



5. Extremophiles …

1. Live in extreme conditions.
2. Demonstrate the wide range of habitability
3. Typically die outside their extreme environment.
4. All of the above.