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Level 3 Earth and Space Science 2022

91413 Demonstrate understanding of processes in the ocean system

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of processes in the ocean system.	Demonstrate in-depth understanding of processes in the ocean system.	Demonstrate comprehensive understanding of processes in the ocean system.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (////). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL 12

QUESTION ONE: THERMOHALINE CIRCULATION

Thermohaline circulation, also called the Global Ocean Conveyor Belt, is the part of general oceanic circulation controlled by horizontal and vertical differences in temperature and salinity.

Adapted from: https://hchscollier.weebly.com/uploads/6/5/1/8/65182593/day_6_-_el_nino_la_nina_notes.pdf

Explain, in detail, the effects of temperature and salinity on the transport of matter and energy through thermohaline circulation.

Your answer should:

- include on the diagram above, labels where upwelling and downwelling occur
- explain the processes of upwelling and downwelling
- explain how downwelling drives thermohaline circulation
- comprehensively explain how heat energy and nutrients are transported through thermohaline circulation.

An annotated diagram may assist your answer.

The thermohaline current is driven by down-welling of cold, dense and salty water. This wate plunges down into the depth in the poles, this ~~wate~~ creates a huge ~~wate~~ deep wate current which flows around the world.

Down-welling occurs ~~the~~ when any wate which is less dense than the wate above it sinks below it. Up-welling is when wate from below the surface rises from deep wate. This usually happens and wate currents hit land masses forcing the wate up.

The thermohaline moves cold and warm wate around the globe along with nutrent rich deep waters. The movement of this current is effected by the cornols effect which in the north hemisphere will drive the currecnt eastward and in the Souther hemisphere will drive the current ~~southwa~~ westward. up-welling bring the nutrent rich wates ~~above~~ into the uppr layer of the ocean and down-welling helps take nutrents dow to the deepocean for deep ocean organisims.

Down-welling is what drives the Thermohaline circulation and downwelling is a result of density differences. Density is effected by temperature and salinity. ~~Hotter water is less dense than water~~. The warmer the water the less dense it is as the particles as they are heated move further apart making them buyant. The saltier the wate the more dense it is as the salt adds to the mass of the wate making it mare or less dense. Meaning cold, salty wate is the most dense, fresh

There is more space for your answer to this question

QUESTION TWO: OCEANIC CARBON PUMPS

The ocean is important in the global carbon cycle, and is an important carbon sink.

Source: https://oceanacidifcationgeog5.wordpress.com/2015/03/10/ocean-acidification/

Explain, in detail, how carbon moves into the ocean, and how changes in atmospheric carbon dioxide impact ocean carbon chemistry.

Your answer should include:

- a detailed explanation of the biological ocean carbon pump
- an explanation of the processes involved in the physical ocean carbon pump (include equations)
- a comprehensive explanation of how the biological and physical carbon pumps may change with an increase in atmospheric carbon dioxide levels.

An annotated diagram may assist your answer.

The biological ~~pump~~ pump is driven by organisims, in this case organisims in the ocean. These organisims may carry out photosynesis which combines sunlight, with carbon and water to creates energy for the plants this processes removes carbon from the ocean. organisims also carry out rosperation in which they take the oxygen from the water and as a by product is the release of carbon into the ocean. organisims also use carbon in the form of calcium carbonate to make there shells. when these organisims die ~~any carbon~~ they sink to the bottom of the ocean and ~~they~~ become apart of the ocean floor and sedimentary rocks which trap carbon for a long time.

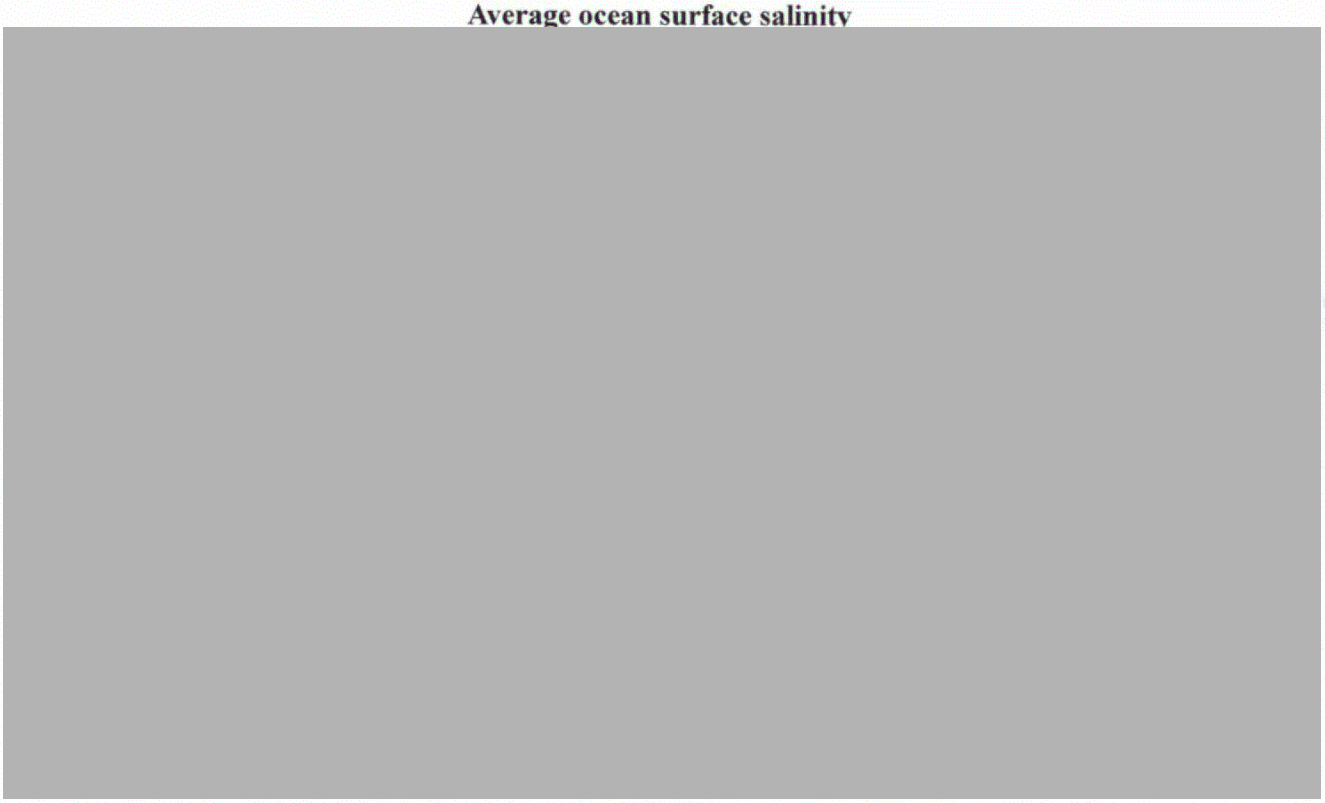
In the physical carbon ~~pump~~ pump carbon desolves into the water this creats carbonic acid the carbonic acid further ~~dis~~ ~~dissociat~~ discosiates into bicarbonatss and ~~hydrogen ions. The hydrogen is acidic~~ then to carbonate and hydrogen ions. ~~The hydrogen in the ocean makes it more~~ the carbonic acid makes ocean more acidic ~~in the acidity can interupt the biological pump~~. Normal levels of carbon ~~ente~~ ~~enter~~ entering the ocean will cycle through ~~carbon enter enters and the ocean will balance~~ maintaining it's normal ~~acidit~~ pH level which is relatively alkaline. If carbon in the atmosphere increases it will acidig the ocean which will disrupt the biological pump as the shells will melt, and could kill organisims.

which organisims use in the form of calcium carbonate to create their shells

There is more space for your answer to this question

QUESTION THREE: OCEAN SURFACE SALINITY

Average ocean surface salinity



Adapted from: https://salinity.oceansciences.org/smap-salinity.htm

The ocean contains a large amount of salt in solution. The above map shows how the salinity of the surface layer of the ocean varies globally.

Explain, in detail, the factors that affect the global variations in surface ocean salinity.

Your answer should:

- explain the reasons why the ocean contains salt
- explain the processes that increase and decrease the salinity of the surface ocean layer
- discuss why salinity varies between the Equator, mid latitudes, and poles.

An annotated diagram may assist your answer.

Salt is added to the ocean from the weathering and erosion of rock and minerals on the earths surface. These rocks and minerals make there way through runoff and water streams lakes, rivers which traspot them to the ocean.
Ocean salinity will increases with the evaporation of water in the ocean, and the formation of sea ice. Evaporation takes water out of the ocean and leaves all the salt behind this results in an increase of salinity. The formation of sea ice is similar as ice forms the salt is forced out which agan increases salinity.
Percipatation and decreise salinity as water is added into the ocean, as well as the constant flow of fresh water into any given part of the ocean.

~~The equator has high percipitation and ratio this should~~. Anywhere on earth where their is low peripitation, or low fresh water imputs ~~should~~, and high evaporation ~~should~~ should have high ocean ~~salty~~ salinity such as the mediteranian sea in mid-latitudes. The poles, have ~~high perc~~ low percipatation and ~~for a~~ formation of sea ice which will incresse salinty but the cold dense water, takes all the high saline water to the deep ocean so the surface salinity is not as high but still relatvey high. The equator has very high percepitation rates so the salinity should not be too high

There is more space for your answer to this question

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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QUESTION NUMBER

Standard	91413	Display ID NSN		**Total score**	12
Q	**Grade score**	**Annotation**			
1	A4	The candidate has provided succinct descriptions that show an understanding of where and how upwelling/downwelling are able to transfer nutrients through the ocean.			
2	A4	The candidate has clearly described aspects of the physical and biological pump. They've also identified the formation of carbonic acid and how this can impact the pH of the ocean.			
3	A4	The candidate has given clear descriptions of processes that increase and decrease salinity in the ocean. Reasons for salinity differences at each location have also been included. To improve this response, the candidate should have included more detail on the idea of solar insolation.			