Water, carbon, climate and life on earth *3.1.1.4* ANSWERS

Q1	***Match the terms with their system definition***	
A	The result of an overall surplus or deficit between the magnitude of inputs compared with output.	**Net change**
B	Change being introduced to a system which impacts on a change in the nature or magnitude of outputs.	**Dynamism**
C	When an input becomes amplified by the outputs generated by a system	**Positive feedback**
D	When the system is stable with little overall change even though there may be continuous new inputs balanced by outputs.	**Equilibrium**
E	When the effect is to dampen down change introduced by inputs as the outputs impede new inputs.	**Negative feedback**
Positive feedback Dynamism Negative feedback Equilibrium Net change		

Q2	**Tick if these are primarily elements of the Water cycle, Carbon cycle – or Both**	**Water c.**	**Carbon c.**
A	Precipitation	✓	✓
Precipitation is a key transfer in the water cycle but is also essential for the weathering of terrestrial rocks containing carbon in the slow carbon cycle as acid rain.			
B	Photosynthesis		✓
The main way carbon is transferred between the atmosphere and the biosphere (plants) both on land and in the seas (phytoplankton). It's a gas transfer that doesn't involve the water cycle directly.			
C	Transpiration	✓	
A transfer of moisture from plants (and the soil) to the atmosphere. A key element of the hydrological cycle.			
D	Decomposition		✓
As bacteria break down organic material (both plant and animal) carbon gas is emitted as they digest biomass. Where air is present CO2 is released, where air is absent CH4 is released.			
E	Chemical weathering of rocks by running water		✓
Carbonic acid (precipitation plus CO2) dissolves rocks such as calcium carbonate, transferring carbon to the oceans as part of the slow carbon cycle. While water is involved it's not key to the hydrological cycle.			
F	Channel flow	✓	✓
Channel flow is key to transferring water between land and oceans in the hydrological cycles, and carbon between land and ocean in the carbon cycle.			
G	Soil storage of precipitation	✓	
Soil storage regulates the speed at which water is recycled within the hydrological system. It may influence whether decomposition is aerobic or anaerobic in the carbon cycle but is not a key determinant of whether carbon is released or not – just its form.			

© Tutor2u Limited 2016

Water, carbon, climate and life on earth *3.1.1.4* ANSWERS

Q3	**Which of these statements accurately describes the relationship between the Water cycle and the Carbon cycle**		
		True	***False***
A	Increased precipitation results in increased biomass which outputs more carbon dioxide.		✓
Biomass absorbs CO2 and releases O2, not the other way around.			
B	More atmospheric CO2 increases global temperatures which increases evaporation generating more precipitation.	✓	
There is a complicated relationship in which more evaporation leads to more cloud cover which can increase cloud albedo and dampen temperature rise, but it holds for initial stages.			
C	Greater intensity of precipitation leads to more weathering of surface rocks which releases more carbon compounds into the sea.	(✓)	
Yes – depending on where the greater precipitation is occurring and whether it correlates with surfaces containing carbonates. Increased precipitation varies from region to region, hence the brackets.			
D	More CO2 in oceans from ocean-atmosphere exchange results in warmer oceans that leads to additional evaporation & more clouds.		✓
While CO2 in the atmosphere leads to increased warming it doesn't have the same 'warming' effect in oceans. Oceans are getting warmer because of a warmer atmosphere.			
E	Increased atmospheric CO2 fertilises growth of biomass which increases transpiration rates and encourages more precipitation.	✓	
There is evidence of faster growth of vegetation in many parts of the world as atmospheric CO2 levels rise, which will draw more water from the soil and create conditions for raincloud formation.			

© Tutor2u Limited 2016

Water, carbon, climate and life on earth *3.1.1.4* ANSWERS

Q4	***How are human actions affecting the Water and Carbon cycles? List effects in one box or the other, or both.***	
A	Reducing natural vegetation to clear land for pastoral agriculture and plantation agriculture.	***Water cycle*** *Reduced transpiration so less precipitation. That which does fall will have less interception so faster surface flow to drainage systems. Less water storage in biomass & soils.*
		Carbon cycle *Less vegetation to absorb carbon dioxide from the atmosphere so greater build up. Cattle are key emitters of methane which increases the carbon content of the atmosphere further with an even more potent greenhouse gas than CO2. Reduced soil storage of carbon under plantations.*
B	Burning fossil fuels in increasing quantities (coal, oil and gas)	***Water cycle*** *Indirect effect of warmer global temperatures increases evaporation and precipitation – though the latter is not regularly distributed over the globe. Increased flow in previous cryosphere regions. Greater input into ocean store.*
		Carbon cycle *Greater atmospheric carbon content. Increases global temperature and feeds biomass which absorbs more CO2. Greater CO2 uptake by oceans initially in ocean-atmosphere gas exchange, but as oceans warm their capacity to absorb CO2 reduces.*
C	Expanding urban areas and transport networks over increasing areas of the earth with more concrete and asphalt (tarmac).	***Water cycle*** *Increased surface flow and reduced groundflow as permeable natural surfaces are replaced by impermeable artificial surfaces. Shorter lag time for channel increase after precipitation and faster discharge to output region (lakes/sea). Increased evaporation rate from surface stores as less water is contained underground.*
		Carbon cycle *Removal of vegetation is likely as settlement expands reducing absorption of atmospheric CO2. New transport routes tend to encourage greater vehicle use which can increase burning of fossil fuels (as do domestic/industrial buildings) which may take more carbon from sequestered long-term hydrocarbon stores (oil reserves) and release the carbon into the atmosphere.*

© Tutor2u Limited 2016

Water, carbon, climate and life on earth *3.1.1.4* ANSWERS

Q5	***The implications for life on earth of changing water and carbon cycles focuses on the negative. But it is unlikely to be disadvantage for all. What may be the pros and cons for human activity of the following changes?***		
A	***Increased precipitation***	***Pros*** • More water for agriculture in dry areas so food production increases. • More water collection possible in dry urban areas, improving sanitation and human health. • More water for industry so processes can be done more economically.	***Cons*** • Flooding is more likely, more frequent and more intense creating hazards to life and threatening agricultural production. • Reservoirs fill with silt more rapidly reducing their storage capacity. • Lower sunshine levels reducing crop yields.
B	***Reduced precipitation***	• Areas prone to flooding are less impacted and can carry on economic activities with less interruption. • Less rapid soil erosion. • Crops which require a dry period to ripen can grow. • Higher sunshine levels encourage tourism activity.	• Less water for agriculture – yields decline. • Less water for human uses – leading to health being compromised. • Less water for essential industries = production losses. • Less water for HEP schemes leading to power shortages.
C	***Higher annual global temperatures***	• Extension of cultivation into higher latitudes. • Opening up of more efficient sea lanes for cargo around the Arctic ocean. • Extension of mineral operations into areas previously too cold (Arctic oil drilling). • Areas previously considered too cold become tourist destinations.	• Negative effects on human health of high temperatures (hyperthermia). • Reduced economic activity under very high temperatures. • Increased evaporation of surface water requiring additional water inputs (if available). • Greater use of air conditioning which may rely on fossil fuel use.
D	***More intense, frequent and extensive tropical storm events***	• Alternative tourist venues outside tropical storm paths become more attractive. • Engineering design and construction firms have more business building structures that can withstand stronger storms. (adaptation) • Effective storm warning systems are put in place (mitigation)	• Increased loss of life • Increased disruption to port cities operation. • Greater costs for insurance and building up contingency funds. • Disruption to international trade flows. • Disruption to offshore oil and gas drilling rigs. • Extension of storm damage to new, unprepared areas.

© Tutor2u Limited 2016