Global carbon stores and changes in magnitude *3.1.1.3* ANSWERS

Q1	***Match the terms with their carbon description***	
A	Carbon dioxide and methane in a free gaseous state	**Atmosphere**
B	Calcium Bicarbonate solution	**Hydrosphere**
C	Organic carbon that is subsurface and undergoing decomposition	**Pedosphere**
D	Solid carbon compounds slowly moving in tectonic plate rocks	**Lithosphere**
E	Organic carbon that is subsurface and is preserved from decomposition	**Cryosphere**
Lithosphere Cryosphere Atmosphere Hydrosphere Pedosphere		

Q2	**Tick whether these involve the Slow or Fast carbon cycles**	**Slow**	**Fast**
A	Plant growth via photosynthesis		✓
B	Acid rain wearing away surface rocks through chemical weathering	✓	
C	Volcanic eruptions at destructive margins	✓	
D	Ocean/Atmosphere gas exchange		✓
E	Tectonic plate movement	✓	
F	Fossil tree remains converting to coal	✓	
G	Zooplankton feeding on Phytoplankton and digesting them		✓

Q3	**What changes will take place to the carbon stores in the following situations (+ , - , or =)**			
A	Rainforest is cleared for agriculture	**Biosphere**	**Atmosphere**	**Pedosphere**
		-	**+**	**-**
The amount of vegetation will decline reducing the biomass store, there will be less absorbed by vegetation from the atmosphere and with less plant growth, less material decomposes in soil				
B	An increase in volcanic eruptions	**Atmosphere**	**Lithosphere**	**Cryosphere**
		+	**-**	**=**
Volcanoes emit carbon dioxide sourced by the melting of lithosphere rocks. The cryosphere is not directly affected but it will depend on whether temperature rise results from increased atmospheric CO2. That is not an inevitable result – it depends on other fluxes.				
C	Depletion and exploitation of crude oil deposits	**Atmosphere**	**Biosphere**	**Hydrosphere**
		+	**+**	**+**
Burning any hydrocarbon releases CO2 into the atmosphere. This will fertilise the growth of vegetation. More atmospheric CO2 will increase the atmosphere/ocean exchange increasing CO2 in seas.				
D	Increase in coral reef growth where warmer oceans extend their range	**Hydrosphere**	**Atmosphere**	**Lithosphere**
		+	**+**	**=**
Corals are animals that exhale CO2 into the sea, which will increase exchange to the atmosphere. Corals are not 'rocks' so don't change the lithosphere though over very long periods of time their remains may contribute to ocean bed sediments which could create new calcium carbonate rocks.				
E	Quarrying of limestone and marble to construct new city expansion	**Lithosphere**	**Atmosphere**	**Biosphere**
		=	=	-
Quarrying stone moves it from one location to another, but it is still 'lithified carbon' even as building stone. The atmosphere won't be affected directly, but biosphere store is likely to decline as growing settlements usually remove natural vegetation.				

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Q4	***Rank (& justify selection) the following carbon stores in terms of their current rate of change where 1= fastest rate of change and 4 = slowest rate of change***
Cryosphere	***Hydrosphere***
3 The cryosphere is changing slowly, although this may be more rapid in future. At the moment there is a net carbon sink in tundra areas as warmer, longer growing seasons stimulates vegetation growth. Although carbon dioxide and methane are being released from melting permafrost, the rate is still one of a slow net absorption of carbon. However, this may change to a net output if atmospheric temperatures increase rapidly.	4 The oceans are one of the most stable carbon stores, exchanging surplus carbon with the atmosphere and recycling carbon through ocean currents, marine sediments and marine biomass. However, there are signs that oceans are beginning to warm which will reduce their capacity to absorb carbon dioxide from the atmosphere, limit the capacity for shell-forming marine organisms to absorb calcium bicarbonate and may inhibit other marine biomass.
Atmosphere	***Biosphere***
1 Atmospheric carbon dioxide is rising at an increasingly rapid rate. In 1960 there were fewer than 320 ppm (parts per million) of CO2 in the atmosphere. The 350 point was hit in 1987, 380 in 2005 and 400 by 2015. The rate of change is greater than any other carbon store and the rate of increase is getting faster. It is nearly all due to the burning of fossil-fuel hydrocarbons (coal, oil and gas).	2 What may be a surprise is the increase in the biospheric carbon store as global vegetation mass actually increases (and marine biomass is largely stable). Additional atmospheric CO2 is thought to be responsible for stimulating more vegetation growth on earth, despite widely reported rainforest loss. The greening of previously farmed areas in Russia, and the deliberate afforestation of land in China and much of Africa is thought to be responsible also.

Q5	***Construct a flow diagram to illustrate the positive feedback loop that may amplify global warming as the Cryosphere undergoes change***