The carbon budget on land, ocean and atmosphere *3.1.1.3* ANSWERS

Q1	***True or False?***	
A	Atmospheric carbon levels are increasing because oceans are releasing more	**False**
B	The terrestrial carbon cycle is the only one that involve biological processes	**False**
C	There is a relationship between carbon cycles on land and the atmosphere	**True**
D	Carbon levels in the atmosphere have been rising ever since life first evolved	**False**
E	Ocean, terrestrial & atmospheric cycles are sub-sets of the global carbon cycle	**True**

Q2	**Match the correct term to the correct carbon cycle process**	
A	Carbon deposits being contained in sedimentary deposits on deep ocean floors.	**Sequestration**
B	Magnesium carbonate mountains being converted from a solid into soluble magnesium bicarbonate.	**Chemical weathering**
C	Diffusion of carbon dioxide from one medium to another in a two-way reversible process, but usually more in one direction than another.	**Ocean-atmos. exchange**
D	Carbon deposits deep in the ocean being buried, compressed and converted under heat and pressure.	**Lithification**
E	Carbon moving from atmosphere into plants through photosynthesis, building biomass, dying, decomposing and being fed on by soil bacteria.	**Fast carbon cycle**

Select from: **Ocean-atmosphere exchange** **Lithification** **Chemical weathering** **Fast carbon cycle** **Sequestration**

Q3	**Allocate the terms/phrases to the most appropriate carbon sub-cycle (poss. more than 1)**		
Terrestrial carbon cycle	***Ocean carbon cycle***	***Atmospheric carbon cycle***
Dry decomposition	Marine snow	Gas exchange (net loss)
Surface biomass	Calcification	Acid rain (2)
Acid rain (1)	Photosynthesis (2)	Methane radiation absorption
Solid-soluble conversion	Zooplankton	
Photosynthesis (1)	Bicarbonate ions	

Marine snow Dry decomposition Gas exchange (net loss) Calcification

Surface biomass Acid rain Solid-soluble conversion

Photosynthesis Zooplankton Bicarbonate ions Methane radiation absorption

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Q4	***Graph the changing proportion of carbon dioxide in the atmosphere. Describe the change and suggest reasons.***

Year	Atmospheric CO2 ppm
1960	320
1970	329
1980	342
1990	356
2000	373
2010	392
2016	407
2050	?

Describe the overall trend: a rise in CO2
Describe the magnitude of change: increased by 87 ppm in 56 years which is over a 25% increase on the 1960 baseline.
Describe the rate of change: an increasingly fast rate of change (9 ppm in 1960s decade, 14 ppm in 1980s decade, 19 ppm in 2000s decade)
Describe the consistency of the change: always been increasing at an ever increasing rate. No fluctuation. No reason to think this will change in the next decade.

Reasons: human release of CO2 from sequestered hydrocarbons at increasing volume for energy, transport, industry etc.
Also, destruction of natural vegetation reducing biomass that could absorb additional CO2.
Also, oceans becoming warmer and more acid which may reduce their potential to absorb CO2.

Q5	***Explain how different feedback cycles operate in carbon regulation on the earth***
A	A negative feedback process regulating carbon transfers Additional CO2 in atmosphere fertilises biomass, promoting additional and faster growth. This vegetation absorbs more CO2 through photosynthesis, drawing it down from the atmosphere and dampening down the rate at which atmospheric CO2 increases. The basis of reforestation/afforestation programmes of carbon capture in carbon trading schemes.
B	A positive feedback process amplifying carbon transfers Rising atmospheric temperatures cause oceans to become warmer. Warmer oceans less able to absorb CO2 from atmosphere so more stays in the atmosphere, resulting in higher temperatures, which warms oceans more…. Rising atmospheric temperatures cause cryosphere to melt, releasing methane which is a potent greenhouse gas. More atmospheric warming, leading to more melting, which releases more methane ….. Rising atmospheric temperatures cause ice cover to melt, which replaces a high albedo with a low one as darker rock, sea and vegetation surfaces replace ice. More solar radiation absorption leads to more melting, which causes temperatures to rise….