

3.4 Ocean Systems			Curriculum Integration <i>(links with other learning areas)</i>	
Title 91413 Demonstrate understanding of Ocean Systems	Learning Area Context(s)/Strand(s) Astronomical systems • Investigate the conditions on the planets and their moons, and the factors affecting them. Earth systems • Investigate the composition, structure, and features of the geosphere, hydrosphere, and atmosphere.	Duration 20 Lessons		
Achievement Level(s) & Objective(s) Level 6 Science, Planet Earth and Beyond Level 7 Science, Planet Earth and Beyond			Key Vocabulary Polarity Density Surface tension Specific heat capacity Latent heat Sensible heat Pycnocline Halocline Thermocline Downwelling Upwelling El Nino La Nina Carbon Sink Carbon Cycle Physical Pump Biological Pump Phytoplankton Acidification Boundary Currents Transverse Currents Circumpolar Currents El Nino/ENSO La Nina Trade Winds	Resources Powerpoints on the shared “ESS National” Google Drive Homework and notes sheets from “ESS National” (Labelled HWK) Past Paper Questions Videos <ul style="list-style-type: none"> • Ekman video https://www.youtube.com/watch?v=zYms4IHpgL • Met Service Video (El Nino) https://www.youtube.com/watch?v=WPA-KpldDV • Space Science Tutorial (Tides) https://www.youtube.com/watch?v=Hdl_PyMFNr • Bozeman Science: Ocean Acidification https://www.youtube.com/watch?v=fgBozLCGUHY • Colour change with depth https://www.youtube.com/watch?v=AAJdA6b4Ts OA not OK (eBook) https://skepticalscience.com/docs/OA_not_OK_Mackie_McGraw_Hunter.pdf Change in Atmospheric Carbon Modelling https://www.esrl.noaa.gov/gmd/ccgg/obspack/data.php
Key Competencies <input checked="" type="checkbox"/> Thinking <input checked="" type="checkbox"/> Using Language <input checked="" type="checkbox"/> Symbols and Texts <input type="checkbox"/> Managing Self <input type="checkbox"/> Relating to Others <input checked="" type="checkbox"/> Participating and Contributing				
Nature of Science Focus Understanding about science <ul style="list-style-type: none"> • Understand that scientists’ investigations are informed by current scientific theories and aim to collect evidence that will be interpreted through processes of logical argument. Investigating in science <ul style="list-style-type: none"> • Develop and carry out more complex investigations, including using models. • Show an increasing awareness of the complexity of working scientifically, including recognition of multiple variables. • Begin to evaluate the suitability of the investigative methods chosen. Communicating in science <ul style="list-style-type: none"> • Use a wider range of science vocabulary, symbols, and conventions. • Apply their understandings of science to evaluate both popular and scientific texts (including visual and numerical literacy). Participating and contributing <ul style="list-style-type: none"> • Develop an understanding of socio-scientific issues by gathering relevant scientific information in order to draw evidence-based conclusions and to take action where appropriate. 				

Learning Outcomes/Intentions What should the students learn?	Possible Learning Experiences (strategies/activities) How can the students achieve this?	Assessment (formative/summative) How can learning & achievement be measured?	Teacher Preparation and Resources
1. Background information <ul style="list-style-type: none"> Energy and matter inputs and transfers Coriolis effect 	Notes on key concepts Coriolis effect demonstration (turntable and marble)		Ppt "1. Background information for Oceans and Atmospheres" Argofloat http://www.euroargo-edu.org/explore/argoeu_3a.php#h5 Colour Change at Depth https://www.youtube.com/watch?v=AAJdA6b4Ts
2. Essential properties of water <ul style="list-style-type: none"> Polarity Density Surface tension Specific heat capacity Latent heat Sensible heat 	Notes on key concepts Experiment- floating a paperclip on water (then add detergent)		Ppt "2. Essential properties of water" Density of water demo https://www.youtube.com/watch?v=bN7E6FCuMbY
3. Ocean structure and composition <ul style="list-style-type: none"> Temperature Salinity Density How they change with depth	Notes on key concepts Experiment- floating fresh water on saturated salt water	PPaper 2013 Q3 Layering in the Ocean (Thermoclines) PPaper 2016 Q1 Ocean Layers PPaper 2018 Q1 Why does salinity vary with latitude	Ppt "3. Ocean Structure" Hwk Background Layers and Gradients
4. Thermohaline circulation <ul style="list-style-type: none"> Causes (salinity, temperature, density) How/where it happens Effects (nutrients, heat movement) 	Notes on key concepts Demo- fish tank , blue ice cube , red hot water Classroom activity- how does Ocean Circulation affect New Zealand	2015 Q1 Thermohaline Circulation (causes) 2016 Q2 Gulf Stream 2017 Q3 Melting Ice Caps effect on Thermohaline Circulation 2018 Q2 Upwelling and downwelling (energy, climate, CO ₂) Grade exemplars -THC	Ppt "4. Thermohaline Current" HWK "THC"

5. Surface Ocean Currents <ul style="list-style-type: none"> • Causes (sun, wind, gravity, Coriolis effect) • Importance • Ekman spiral (energy transfer) • Named currents • Transporting heat 	Notes on key concepts Coriolis effect demo- turntable/marble	PPaper 2013 Q1 Ocean Surface Circulation causes PPaper 2014 Q1 Ocean (surface) Circulation PPaper 2016 Q3 Ocean Gyres (South Pacific) PPaper 2017 Q1 Boundary Currents (upwelling)	Ppt "5. Surface Ocean Currents" HWK "Surface Currents" Ekman video https://www.youtube.com/watch?v=zYms4IHpgLc
6. El Nino and La Nina <ul style="list-style-type: none"> • Normal vs El Nino/La Nina conditions • Print diagrams of each • Causes • Effects on Pacific • Effects on NZ 	Atmospheric Pressure Demos Predicting EL Nino Classroom Activity Notes on key concepts	2014 Q3 El Nino (Formation/Thermocline) 2015 Q2 El Nino Effects on Pacific Ocean 2018 Q3 EL Nino/La Nina (thermocline, climate, fishing in Peru)	Ppt "6. El Nino Southern Oscillation" HWK "El Nino La Nina" Met Service Video https://www.youtube.com/watch?v=WPA-KpldDVc
7. Waves and tides <ul style="list-style-type: none"> • Causes of Waves • Energy Transfer • Tides (spring/king, neap) 	Notes on key concepts	No past paper question as yet	Ppt "7. Waves and Tides" HWK "Waves and Tides" Space Science Tutorial Vid https://www.youtube.com/watch?v=Hdl_PyMFNro
8. Carbon Cycle <ul style="list-style-type: none"> • Carbon Sinks • Add/remove CO₂ • Physical Pump • Biological Pump • Importance of phytoplankton 	Notes on key concepts Print diagrams carbon cycle/biological pump	PPaper 2014 Q2 The Biological Pump PPaper 2015 Q3 Temperature and the Carbon Cycle PPaper 2017 Q2 Carbon Cycle	Ppt "8. Carbon Cycle" Change in Atmospheric Carbon Modelling https://www.esrl.noaa.gov/gmd/ccgg/obspack/data.php
9. Ocean Acidification <ul style="list-style-type: none"> • Chemistry processes • Carbon Dioxide Acidification chemistry • Carbonate equilibrium • Effects on marine ecology 	Notes on key ideas Ocean Acidification Investigation	PPaper 2013 Q3 Carbon Chemistry (ocean acidification)	Ppt "9. Ocean Acidification" HWK "Carbon Cycle and OA" Vid: Bozeman Science: Ocean Acidification Demystifying Ocean Acidification OA not OK (eBook) Acid Test: The Global Challenge of Ocean Acidification

