Assessment Schedule – 2011.

Scholarship Science (93104).

Evidence Statement

Q	2	4	6	8
ONE	Points from: Speed of sound: • Sound speed increases with increasing temperature (sound speeds at warmer, shallower depths are faster than those at 1000 m). • Sound speed increases with increasing pressure (sound speeds at depths beyond 1000 m increase as the pressure increases but the temperature hardly changes).	Developed points from: Speed of sound: • Sound speed increases with increasing temperature (sound speeds at warmer, shallower depths are faster than those at 1000 m). • Sound speed increases with increasing pressure (sound speeds at depths beyond 1000 m increase as the pressure increases but the temperature hardly changes). Factors that cause the Deep Sound Channel: • The deep sound channel represents a cross-over point between decreasing velocity as the temperature drops with increasing depth, and increasing velocity as the pressure increases with increasing depth. Sound transmission in the Deep Sound Channel: • Sound waves bend, or refract, or reflect away from regions of faster sound speed and back towards regions of slower sound speed.	Well-developed points from: Speed of sound: • Sound speed increases with increasing temperature (sound speeds at warmer, shallower depths are faster than those at 1000 m). • Sound speed increases with increasing pressure (sound speeds at depths beyond 1000 m increase as the pressure increases but the temperature hardly changes). • Factors that cause the Deep Sound Channel: • The deep sound channel represents a cross-over point between decreasing velocity as the temperature drops with increasing depth, and increasing velocity as the pressure increases with increasing depth. Sound transmission in the Deep Sound Channel: • Sound waves bend, or refract, or reflect away from regions of faster sound speed and back towards regions of slower sound speed. • Low frequency sound moves along the Deep Sound Channel by internal reflection. Gathering information: • Data on ocean warming can be collected by regularly putting a loud sound into the Deep Sound Channel and measuring the time required for the sound wave to reach various remote listening stations.	Well-developed points from: Speed of sound: • Sound speed increases with increasing temperature (sound speeds at warmer, shallower depths are faster than those at 1000 m). • Sound speed increases with increasing pressure (sound speeds at depths beyond 1000 m increase as the pressure increases but the temperature hardly changes). • Factors that cause the Deep Sound Channel: • The deep sound channel represents a cross-over point between decreasing velocity as the temperature drops with increasing depth, and increasing velocity as the pressure increases with increasing depth. Sound transmission in the Deep Sound Channel: • Sound waves bend, or refract, or reflect away from regions of faster sound speed and back towards regions of slower sound speed. . • Low frequency sound moves along the Deep Sound Channel by internal reflection. Gathering information: • Data on ocean warming can be collected by regularly putting a loud sound into the Deep Sound Channel and measuring the time required for the sound wave to reach various remote listening stations. • If the ocean is warming, the depth at which the Deep Sound Channel occurs will become greater. • Ocean mammals can be monitored from a long distance away by recording their low frequency calls.

TWO. (a)	• The DNA of both non-irradiated (control) and irradiated bacteria of each species must be assessed.	Developed points from: . • Grow bacteria under identical conditions. • The DNA of both non-irradiated (control) and irradiated bacteria of each species must be compared.	Well-developed points from: • Choose a range of bacterial species and grow under identical conditions. • One dose radiation to all species of non-control bacteria, then DNA samples taken from control and irradiated bacteria to determine DNA damage . • Amount of DNA damage determined by genetic profiling OR by determining proteins levels from selected genes OR by DNA sequencing	Well-developed points from: • Choose a range of bacterial species that are relevant to food spoilage and grow under identical conditions. • The DNA of both non-irradiated (control) and irradiated bacteria of each species must be compared. • One dose radiation to all species of non-control bacteria, then DNA samples from control and irradiated bacteria taken at realistic intervals afterwards to determine DNA how much damage is repaired . • Amount of DNA damage determined by genetic profiling OR by determining proteins levels from selected genes OR by DNA sequencing.
(b)	• Co-60 emits gamma rays which are very penetrating and are absorbed by the concrete walls (during irradiation)	• Co-60 emits gamma rays which are very penetrating and are absorbed by the concrete walls (during irradiation). They also emit beta particles	• Co-60 emits gamma rays which are very penetrating and beta particles which are less penetrating. . • The gamma rays (and beta particles) are absorbed by the concrete walls (during irradiation) and by the water (when the source is not being used).	• Co-60 emits gamma rays which are very penetrating and beta particles which are less penetrating. . • The gamma rays (and beta particles) are absorbed by the concrete walls (during irradiation) and by the water (when the source is not being used). • Special badges – dosimeters – are worn by personnel to monitor the cumulative dose. • The treatment leaves no residual radiation in the radiated food.

THREE. (a)	• Elaidic, mp suggests a semi-solid or solid state. Trans double bond at single C=C. • Stearic, no double C=C, regular zig-zag shape means that hydrocarbon chains fit together. • Oleic, one cis C=C so one kink in hydrocarbon chain, less dipole-dipole, chains do not pack together, liquid at room temperature, low melting point. . • Linoleic, 2 cis C=C, hydrocarbon chain with 2 kinks, much less dipole-dipole, chains do not pack together, liquid at room temperature	• Elaidic, melting point suggests a semi-solid or solid state. Trans double bond at single C=C. • Trans bonds only give small kinks in hydrocarbon chain so chains pack together, dipole-dipole bonds, solid state. . • Stearic, no double C=C, regular zig-zag shape means that hydrocarbon chains fit together, more temporary dipole-dipole bonds, melting point higher. • Oleic, one cis C=C so one kink in hydrocarbon chain, less dipole-dipole, chains don't pack together, liquid at room temp, low melting point. . • Linoleic, 2 cis C=C, hydrocarbon chain with 2 kinks, much less dipole-dipole, chains don't pack together, liquid at room temp. • Trans fatty acids mimic saturated FA in that chains fit together more easily.	Maximum of 4 marks for part A. Maximum 3 marks for 1st bullet point. • Elaidic acid is the trans fatty acid (FA). A trans C=C bond forms only a small kink in the otherwise straight FA chain. A cis bond causes large kinks in the straight FA chain. • Straight FA chains stack together evenly and form stronger temporary dipole-dipole bonds between the chains compared with kinked chains or converse. • More energy is therefore needed to separate chains if they are evenly stacked together or have stronger temporary dipole – dipole forces therefore they have a higher melting point or converse. Maximum 2 marks for 2nd bullet point. • To make margarine softer cis fatty acids, would replace trans fatty acids. . • The consumption of trans fats increases the risk of coronary heart disease by raising levels of 'bad' cholesterol and lowering levels of good cholesterol.	Maximum of 5 marks for part A. Maximum 3 marks for 1st bullet point. • Elaidic acid is the trans fatty acid (FA). A trans C=C bond forms only a small kink in the otherwise straight FA chain. A cis bond causes large kinks in the straight FA chain. • Straight FA chains stack together evenly and form stronger temporary dipole-dipole bonds between the chains compared with kinked chains or converse. • More energy is therefore needed to separate chains if they are evenly stacked together or have stronger temporary dipole – dipole forces therefore they have a higher melting point or converse. Maximum 2 marks for 2nd bullet point. • To make margarine softer cis fatty acids, would replace trans fatty acids. . • The consumption of trans fats increases the risk of coronary heart disease by raising levels of LDL (bad) cholesterol and lowering levels of HDL (good) cholesterol. • Linoleic and linolenic acid are poly-unsaturated and are essential fatty acids. So they would be reduced in harder margarine but could be present in softer margarine.

(b)	• No transgenic / genes from another species used. • No ethical objections from religious groups.	Developed points from: • No transgenic / genes from another species used. • No ethical objections from religious or health groups. • Less likely to be allergic reaction.	Well-developed points from: • No transgenes / genes from another species used. • No chance of gene escape to other species. • No ethical objections from religious or health groups. • Less likely to be allergic reactions to protein product. • No chance of soya bean genes being damaged / mutated, because no genes have been inserted.	Maximum 4 marks in part B. Well-developed points from: • No transgenes / genes from another species used. • No chance of gene 'escape' to other species. • No ethical objections from religious or health groups. • Less likely to be allergic reactions to protein product. • No antibiotic markers used to identify inserted transgenes. • No chance of soya bean genes being damaged / mutated, because no genes have been inserted. • Eliminates the need for a vector and attendant problems such as viruses not being disabled.

FOUR. (a)	Maximum 2 marks. • The older and denser **oceanic** crust of the Pacific Plate (PP) is subducted under younger, less dense **oceanic** crust of Australian Plate (AP) in Kermadec Arc (KA). • An underwater caldera eruption could cause crater collapse / shock waves / huge force which would displace water and cause a tsunami that would reach NZ.	Maximum 4 marks from points. • The older and denser **oceanic** crust of PP is subducted under younger, less dense **oceanic** crust of AP in Kermadec Arc (KA). • Wet sediment is dragged down with subduction and has largely come from eroded continental crust from NZ, which adds more silica to the magma forming. • Water in sediments becomes super-heated, lowering melting point of surrounding rock forming magma, which ponds beneath the Havre Trough. • An underwater caldera eruption could cause crater collapse / shock waves / huge force which would displace water and cause a tsunami that would reach NZ.	Maximum 5 marks from developed points. • As the older and denser **oceanic** crust of PP subducts under younger, less dense **oceanic** crust of AP in Kermadec Arc (KA) the leading edge of the Australian plate is dragged down too, stretching and thinning the Havre Trough. • Wet sediment is dragged down with subduction and has largely come from eroded continental crust from NZ, which adds more silica to the magma forming. • Water in sediments becomes super-heated, lowering melting point of surrounding rock forming magma, which ponds beneath the Havre Trough. • Water and carbon dioxide (from subducted carbonates) come out of solution and are trapped by viscous rhyolite magma which makes eruption very explosive, forming caldera. • An underwater caldera eruption could cause crater collapse / shock waves / huge force which would displace water and cause a tsunami that would reach NZ.	Maximum 6 marks from well-developed points. • As the older and denser **oceanic** crust of PP subducts under younger, less dense **oceanic** crust of AP in Kermadec Arc (KA) the leading edge of the Australian plate is dragged down too, stretching and thinning the Havre Trough. • Because the crust is thinner in the Havre Trough, the mantle underneath the crust is closer to the sea floor than normal, which heats and softens the rock more. • Wet sediment is dragged down with subduction and has largely come from eroded continental crust from NZ, which adds more silica to the magma forming. • Water in sediments becomes super-heated, lowering mp of surrounding rock forming magma, which ponds beneath the Havre Trough. • Water and carbon dioxide (from subducted carbonates) come out of solution and are trapped by viscous rhyolite magma which makes eruption very explosive, forming caldera. • The heat from the subduction and magma forming may cause localised convection currents and localised seafloor spreading. This causes the spreading behind the subduction zone. . • An underwater caldera eruption could cause crater collapse / shock waves / huge force which would displace water and cause a tsunami that would reach NZ.

(b)	Maximum 1 mark. • The heat source for the hydrothermal vent will come from magma . • The water source from ocean water.	Maximum 2 marks. • The heat source for the hydrothermal vent will come from magma . • The water source will most likely come from ocean water. • The tectonic and volcanic stress on the ocean floor will cause faults or fracture in the rocks.	Maximum 2 marks from developed points. • The heat source for the hydrothermal vent will come from magma . • The water source will most likely come from ocean water, or possibly from magma or subducted watery sediments. . • The tectonic and volcanic stress on the ocean floor will cause faults or fracture in the rocks, so that the water can move up and down. • Hot hydrothermal fluid is **suddenly cooled** by contact with cold seawater as soon as it leaves the vent.	Maximum 3 marks from well-developed points. • The heat source for the hydrothermal vent will come from magma . • The water source will most likely come from ocean water, or possibly from magma or subducted watery sediments. . • The tectonic and volcanic stress on the ocean floor will cause faults or fracture in the rocks, so that the water can move up and down. • The thinning crust and the ponding magma may also be why the vents are found in this region. • Hot hydrothermal fluid is **suddenly cooled** by contact with cold seawater as soon as it leaves the vent causing minerals in the fluid to precipitate out of the solution and settle around the vent, forming the chimney.

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