Assessment Schedule – 2009

Scholarship Science (93104)

Evidence Statement

Note: One or more accurate points very well developed, a discussion coherently presented or particular insights can also be rewarded.

Q	2	4	6	8
ONE	**1-2 clear points such as shown below** • Shape, size and texture are determined by intensity of the returning echo. • The larger the object or the larger the face presented to the bat, the greater the reflected intensity. • Hard objects will reflect more strongly than soft objects. • Smooth objects will reflect more strongly than rough objects.	**3-4 clear points such as shown below** • Shape, size and texture are determined by intensity of the returning echo. • The larger the object or the larger the face presented to the bat, the greater the reflected intensity. • Hard objects will reflect more strongly than soft objects. • Smooth objects will reflect more strongly than rough objects. • The speed of prey in a direction towards or away from the bat is determined by the Doppler effect, with the frequency being increased (decreased) as the prey moves towards (away) from the bat. • Distance is calculated by the time echoes take to come back to bat.	**5-6 clear points (or less but well developed) showing linking of ideas such as** • Shape, size and texture are determined by intensity of the returning echo. • The larger the object or the larger the face presented to the bat, the greater the reflected intensity. • Hard objects will reflect more strongly than soft objects. • Smooth objects will reflect more strongly than rough objects. • The speed of prey in a direction towards or away from the bat is determined by the Doppler effect, with the frequency being increased (decreased) as the prey moves towards (away) from the bat. • Distance is calculated by the time echoes take to come back to bat. • Bats catch tiny insects, so need to use a wavelength smaller than the length of the insects. • Ultrasound has a frequency of 20-160 kHz. If the speed of sound is 340 m / s, this corresponds to a wavelength of, $l = v / f$ = 340 / 160,000 m through to 340 / 20,000 = 2–17 mm. • The higher the frequency, the greater the resolution, but too high would be a waste of energy. • If bats used lower frequency sound waves, their prey could hear them coming.	**7-8 clear points (or less but well developed) showing understanding such as** • Shape, size and texture are determined by intensity of the returning echo. • The larger the object or the larger the face presented to the bat, the greater the reflected intensity. • Hard objects will reflect more strongly than soft objects. • Smooth objects will reflect more strongly than rough objects. • The speed of prey in a direction towards or away from the bat is determined by the Doppler effect, with the frequency being increased (decreased) as the prey moves towards (away) from the bat. • Distance is calculated by the time echoes take to come back to bat. • Bats catch tiny insects, so need to use a wavelength smaller than the length of the insects. • Ultrasound has a frequency of 20-160 kHz. If the speed of sound is 340 m / s, this corresponds to a wavelength of, $l = v / f$ = 340 / 160,000 m through to 340 / 20,000 = 2–17 mm. • The higher the frequency, the greater the resolution, but too high would be a waste of energy. • If bats used lower frequency sound waves, their prey could hear them coming. • The use of ultrasound avoids confusion from other sources of sounds. Direction of the prey can be determined by the slight delay between the signals in the bat's two ears. • The echo is pulsed to provide an accurate time delay and reflected magnitude, without the confusion of a continuously incoming signal. • The use of ultrasound avoids confusion from other sources of sounds.

TWO	**1-2 clear points such as shown below** • A denser atmosphere increases the albedo (supported by a physical argument, such as increased light scattering, or by data from the table). • Clouds increase the albedo as they are very reflective.	**3-4 clear points such as shown below** • A denser atmosphere increases the albedo (supported by a physical argument, such as increased light scattering, or by data from the table). • Clouds increase the albedo as they are very reflective. • The mineral content of surface rocks can increase or decrease the albedo (with an explanation or examples). • A rough (or smooth) surface decreases (increases) reflectivity and the albedo. • Ice increases albedo as it is highly reflective / white.	**5-6 clear points (or less but well developed) showing linking of ideas such as** • A denser atmosphere increases the albedo (supported by a physical argument, such as increased light scattering, or by data from the table). • Clouds increase the albedo as they are very reflective. • The mineral content of surface rocks can increase or decrease the albedo (with an explanation or examples). • A rough (or smooth) surface decreases (increases) reflectivity and the albedo. • Water will decrease the albedo because it absorbs light. • Ice increases albedo as it is highly reflective / white.. • The distribution of ice / liquid / rock over a planet affects the albedo.	**7-8 clear points (or less but well developed) showing understanding such as** • A denser atmosphere increases the albedo (supported by a physical argument, such as increased light scattering, or by data from the table). • Clouds increase the albedo as they are very reflective. • The mineral content of surface rocks can increase or decrease the albedo (with an explanation or examples). • A rough (or smooth) surface decreases (increases) reflectivity and the albedo. • Water will decrease the albedo because it absorbs light. • Ice increases albedo as it is highly reflective / white. • The moon's features provide standard samples that help in the interpretation of measurements of the albedo from distant planets. • The relative angles of the Sun, the planet and the Earth affect the measurement of the albedo (with clear diagram). • The distribution of ice / liquid / rock over a planet affects the albedo.

THREE	**1-2 clear points such as shown below** • Point mutations cause changes in the RNA base sequence. • A change in the code or a base affects the arrangement and / or type of amino acids. • The proteins **change shape, or fold up differently** because of a different aa sequence.	**3-4 clear points such as shown below** • Point mutations cause changes in the RNA base sequence. • A change in the code or a base affects the arrangement and / or type of amino acids. • The proteins **change shape, or fold up differently** because of a different aa sequence. • Therefore, when proteins fold up, the different shape means that the antibodies can no longer attach to them. • The mutations probably spontaneously arise as part of the copying process. • A high mutation rate occurs because so many viruses are being produced at any one time so there are more opportunities for mutations.	**5-6 clear points (or less but well developed) showing linking of ideas such as** • Point mutations cause changes in the RNA base sequence. • A change in the code or a base affects the arrangement and / or type of amino acids. • The proteins **change shape, or fold up differently** because of a different aa sequence. • Therefore, when proteins fold up, the different shape means that the antibodies can no longer attach to them. • If the active site of the protein is now the wrong shape because of the mutation the antibody is now no longer able to bind, this causes more severe symptoms. • Mutations can dramatically change the base and hence the amino acid sequence when they are: - frameshift mutations which changes the bases from the point of the mutation resulting in completely different aa to be coded for - when a mutation codes for a stop codon so that the protein cannot be made from that point. • The mutations probably spontaneously arise as part of the copying process. • A high mutation rate occurs because so many viruses are being produced at any one time so there are more opportunities for mutations. • There is a high mutation rate because they lack polymerases or enzymes that proof-read. • A mutation has no effect when the amino acid is not changed as a result of degeneracy of the aa code.	**7-8 clear points (or less but well developed) showing understanding such as** • Point mutations cause changes in the RNA base sequence • A change in the code or a base affects the arrangement and / or type of amino acids • The proteins **change shape, or fold up differently** because of a different aa sequence • Therefore, when proteins fold up, the different shape means that the antibodies can no longer attach to them. • If the active site of the protein is now the wrong shape because of the mutation the antibody is now no longer able to bind, this causes more severe symptoms. • Mutations can dramatically change the base and hence the amino acid sequence when they are: - frameshift mutations which changes the bases from the point of the mutation resulting in completely different aa to be coded for. - when a mutation codes for a stop codon so that the protein can't be made from that point. • The mutations probably spontaneously arise as part of the copying process. • A high mutation rate occurs because so many viruses are being produced at any one time so there are more opportunities for mutations. • There is a high mutation rate because they lack polymerases or enzymes that proof-read. • RNA has a high mutation rate because RNA lacks the polymerases or enzymes that can proof-read. • RNA is single stranded so there is no template to copy from. • A mutation has no effect when the amino acid is not changed as a result of degeneracy of the aa code. • If a mutation occurs in a part of protein such as the end of the chain or well away from the active site the protein shape is not changed too much, and antibodies can at least partially bind causing mild symptoms. • If both the H and N protein mutate very severe symptoms are caused as no antibodies can attach.

FOUR	**1-2 clear points such as shown below** • Saturated fatty acid (FA) chains have no double bonds resulting in straight FA chains. • Unsaturated FA chains have one double bond (monounsaturated) or more than one (polyunsaturated) resulting in kinks / shape changes in the FA chains.	**3-4 clear points such as shown below** • Saturated FA chains have no double bonds resulting in straight FA chains • Unsaturated FA chains have one double bond (monounsaturated) or more than one (polyunsaturated) resulting in kinks / shape changes in the FA chains. • Straight FA chains means that the degree of intermolecular forces / temporary dipole-dipole forces / van der Waal forces are greater resulting in higher melting points (mp). • Higher mp means more energy is required to break the FA chains apart. • FA chains that are kinked means that the degree of intermolecular forces / temporary dipole-dipole forces / van der Waal forces are less resulting in lower melting points (mp). • Lower mp means less energy is required to break the FA chains apart.	**5-6 clear points (or less but well developed) showing linking of ideas such as** • Saturated FA chains have no double bonds resulting in straight FA chains. • Unsaturated FA chains have one double bond (monounsaturated) or more than one (polyunsaturated) resulting in kinks / shape changes in the FA chains. • Straight FA chains means that the degree of intermolecular forces / temporary dipole-dipole forces / van der Waal forces are greater resulting in higher melting points (mp) because more energy is required to break the FA chains apart. • FA chains that are kinked means that the degree of intermolecular forces / temporary dipole-dipole forces / van der Waal forces are less resulting in lower melting points (mp) and less energy is required to break the the FA chains apart. • Saturated FA more dense than unsaturated FA. • Longer chain fatty acids, would normally increase the mp of fats, but many shown in the table are mono- or polyunsaturated, which reduces mp. • Fish are cold blooded so do not soften fat by warm body temperature. • Density of FA similar to density of cold water which ensures efficient swimming.	**7-8 clear points (or less but well developed) showing understanding such as** • Saturated FA chains have no double bonds resulting in straight FA chains • Unsaturated FA chains have one double bond (monounsaturated) or more than one (polyunsaturated) resulting in kinks / shape changes in the FA chains. • Straight FA chains means that the degree of intermolecular forces / temporary dipole-dipole forces / van der Waal forces are greater resulting in higher melting points (mp) because more energy is required to break the FA chains apart. • FA chains that are kinked means that the degree of intermolecular forces / temporary dipole-dipole forces / van der Waal forces are less resulting in lower melting points (mp) and less energy is required to break the the FA chains apart. • Double bonds can be - *Cis* which cause big kinks - *trans ones* which cause smaller or negligible kinks. Accurate labelled diagram showing the difference accepted. • Saturated FA more dense than unsaturated FA. • Longer chain fatty acids, would normally increase the mp of fats, but many shown in the table are mono- or polyunsaturated, which reduces mp. • Liquid or soft fats at cold temperatures (with low mps) in the membranes means that the fish can swim effectively because the fat will not harden, the fish stay flexible. OR • If cold-water fish membranes had fatty acids with a high mp, it would mean that the fats would be solid and the fish could not swim properly. • Fish are cold blooded so do not soften fat by warm body temperature. • Density of FA similar to density of cold water which ensures efficient swimming.

FIVE	Accurate diagrams accepted instead of equivalent words **1-2 clear points such as shown below** • East North Island (NI), the deep earth-quakes get deeper towards the west, which corresponds to subduction of the oceanic crust Pacific Plate (PP) under the continental crust Australian Plate (AP). • Bottom of South Island (SI) – Fiordland, pattern of deep earthquakes shows that AP subducts steeply under PP. • Middle of SI, very few deep earthquakes because collision of the AP with the PP is causing uplift rather than subduction.	Accurate diagrams accepted as well as equivalent words **3-4 clear points such as shown below** • East NI, the deep earthquakes get deeper towards the west, which corresponds to subduction of the oceanic crust PP under the continental crust AP. • The further west the PP is subducting the closer the depths are registered, which shows that PP is subducting more steeply. • Bottom of SI – Fiordland, pattern of deep earthquakes shows that the oceanic crust AP subducts steeply under continental crust PP towards the east. • Middle of SI, very few deep earthquakes because collision of the AP with the PP is causing uplift rather than subduction. • Shallow earthquakes more widespread and generally follow the tectonic plate boundary.	**Good interpretation of maps required** Accurate diagrams accepted as well as equivalent words **5-6 clear points (or less but well developed) showing linking of ideas such as** • East of the NI, the deep earthquakes get deeper towards the west, which corresponds to subduction of the oceanic crust PP under the continental crust AP. • The further west the PP is subducting the closer the depths are registered, which shows that PP is subducting more steeply. • Bottom of SI – Fiordland, pattern of deep earthquakes shows that the oceanic crust AP subducts steeply under continental crust PP towards the east. • Middle of SI, very few deep earthquakes because collision of the AP with the PP is causing uplift rather than subduction. • Rate of deformation greatest in the region of the Southern Alps, because of uplift of the Alps. Doesn't affect the amount of deep earthquakes, but may affect the amount of shallow ones. • Shallow earthquakes more widespread and generally follow the tectonic plate boundary, except for Taupō Volcanic zone area. • Shallow earthquakes at Taupō Volcanic zone area could be volcanic in origin and also occur when earth is stretched so the crust is thinning. • Deep earthquakes occur only where there is subduction because plate dives deep enough. • Shallow earthquakes are found close to start of subduction because crust cold and brittle and faults form. • Shallow earthquakes occur also when earth is stretched so the crust is thinning.	**Good interpretation of maps required** Accurate diagrams accepted as well as equivalent words **7-8 clear points (or less but well developed) showing understanding such as** • East of the NI, the deep earthquakes get deeper towards the west, which corresponds to subduction of the oceanic crust PP under the continental crust AP. • The further west the PP is subducting the closer the depths are registered, which shows that PP is subducting more steeply. • Bottom of SI – Fiordland, pattern of deep earthquakes shows that the oceanic crust AP subducts steeply under continental crust PP towards the east. • Middle of SI, very few deep earthquakes because collision of the continental crust AP with the continental crust PP is causing uplift rather than subduction. • Rate of deformation greatest in the region of the Southern Alps, because of uplift of the Alps. Doesn't affect the amount of deep earthquakes, but may affect the amount of shallow ones. • Shallow earthquakes more widespread and generally follow the tectonic plate boundary, except for Taupō Volcanic zone area. • Shallow earthquakes at Taupō Volcanic zone area could be volcanic in origin and also occur when earth is stretched so the crust is thinning. • Deep earthquakes occur only where there is subduction because plate dives deep enough. • Shallow earthquakes are found close to start of subduction because crust cold and brittle and faults form. • Shallow earthquakes occur where fault lines (caused by stresses of tectonic movement but are not plate boundaries) have formed. • There is a concentration of shallow earthquakes where the ground is contracting. • Movement along the Alpine Fault is lateral so the earthquakes are shallow.