Assessment Schedule – 2008

Scholarship Biology (93101)

Evidence Statement

QUESTION ONE

	Genetics evidence		Elaboration / Justification
G1	**Point / substitution / gene / missense mutation.**	**G1J1**	• Only **one** amino acid change.
		G1J2	• No frame-shift.
G2	**Autosomal** / not sex- linked.	**G2J1**	• Hb gene is located on chromosome 11.
		G2J2	• Equal frequency in male and female.
G3	Mutation must have occurred in the **germ cell / gametic mutation.**	**G3J1**	• For it to be **passed on** to offspring.

	Inheritance evidence		Justification
H1	**co-dominant /** incomplete dominance.	**H1J**	• Both normal and sickled blood cells are present in the blood.
H2	**Hb^s allele most likely** to be Inherited from **heterozygous parents / describe phenotype.**	**H2J**	• Because homozygous Hb^s Hb^s usually die before reproductive age.
H3	Punnet squares (n x h or h x h) OR in words.		

	Allele frequency Evidence		Elaboration / Justification
F1	**High** / 20% **frequencies** of **Hb^s allele** in **malarial zones** Eg Africa. (Not freq of SCD)	**F1J**	• Hb^s allele / heterozygotes / SCT / carriers (NB: Not SCD). • Provides protection (against malarial) / describes how it provides protection. • Selective advantage.
F2	**Low /** less than 1% / **frequencies** / of **Hb^s allele** in low / **non-malarial zones.** Eg in NZ.	**F2J**	• No advantage to have Hb^s allele / heterozygotes (because no malaria) / Hb^s allele is selected against / HbHb has a selective advantage / 1% in NZ is due to immigration of Africans / gene flow.
F3	In **non-malarial areas**, **frequencies** of **Hb^s allele** will **remain / be maintained** in the gene pool.	**F3J**	• Heterozygous individuals still present / Medical technology is able to reduce fatalities amongst Hb^sHb^s / SCD individuals who can then reproduce, allowing the Hb^s allele to remain in the population / Gene flow from Africa.
F4	**High frequency of Hb^s allele in black Americans** due to **ancestry** / **emigration of people from Africa.**		
F5	**Low frequency** of **Hb^s allele** in some **malarial areas** Eg India, the Mediterranean,	**F5J**	• **Limited** gene flow.

	Biotechnology		Elaboration / justification		Evaluation
B1	**Genetic test** of zygote / embryo / adult, Not: gamete,	**B1J**	• Allows parents choice / SCD embryo identified and not implanted into uterus / Allows for identification of affected individual,	**E1**	• **Not a cure**, gives reason why eg just reduces number of people with SCD.
B2	**Treatments: Hb / normal allele delivered into** body cell,	**B2J**	• Hb allele / stem cells inserted into bone marrow. Use stem cells / bone marrow from healthy individual.	**E2**	**Not a cure** for SCD; Hb^s allele is still present in somatic cell, Hb^s can still be inherited / A cure is only possible when a functioning copy of the gene is inserted AND the defective gene switched off / removed.
Eo	▪ Biotech **unlikely to be effective** in treating SCD because of (described) difficulties in the biotechnology techniques eg Where the Hb is inserted, interferes with the functioning of other genes / Not all cells incorporate the allele ▪ Correct description of why a cure is not possible but not linked to a specific biotech application.				

Q1 Judgement Statement

Mark	Judgement Statement
8	A **logical, coherent answer with minimal irrelevant information and no significant errors** • Evidence provided for 4 areas • 7 justifications (7 J) • E1 or E2
7	
6	• Evidence provided for 4 areas • 5 Justifications (5J) • no E
5	
4	• Evidence provided for 3 areas • 3Justifications (3J)
3	
2	• **3** relevant ideas
1	• **1-2** relevant ideas
0	• No relevant ideas

KEY: to four areas
G = genetics
H = inheritance
F = frequency
B / E = biotechnology / evaluation
n / a =not relevant
n / c = not correct
rep= repetition

QUESTION TWO

Evolutionary Pattern: Antarctic Fish (P1)	**Justification (P1J)**	
Adaptive radiation	• **One** (ancestral) species of **notothenioids** gave rise to **many** notothenioids species. • Originally there was **one notothenioid** species but today there are more 100 sp of notothenioids. • The 100 species of **notothenioids** today **all possess** the **AFGP gene** indicating **common ancestry.**	
Evolutionary Pattern: Antarctic Fish and Arctic Cod (P2)	**Justification (P2J)**	
Convergent / Parallel evolution	**J1.** **Antifreeze gene evolved independently** as each species arose from **different ancestor / unrelated species** **J2.** **Analogous** features / **Same** short repeating **amino acid sequences** found in **both** the Arctic Cod and Antarctic notothenioids: carry out the **same function /** produce **same protein (two ideas needed).** **J3.** AFGP genes in **different location** in **the genomes** indicating they **evolved independently.** **J4.** **Similar selection pressures** on both Arctic Cod and in the Antarctic notothenioids resulted in the evolution of the same **AFGP molecule.**	
Speciation Process (S)	**Elaboration / Justification (SJ)**	**Additional (SE)**
S1. **Mutation** producing AFGP allele present in **original / ancestral / single species / before the speciation occurred.**	• Occurred some time prior to / around the time of: the cooling of the waters.	Mutation **neutral** / does not confer any advantage in warm water
S2. **Selection Pressure. The colder water / decreasing water temperature** acted as a **selection pressure** on the fish.	• Individuals with AFGP gene / protein were selected for / selective advantage / fitter / more likely to survive.	
S3. **Inheritance.** Over time individuals with the AFGP allele **passed on** this **allele** to the next generation.	• The frequency of the AFGP allele increases throughout the population • Directional selection for the AFGP allele.	
S4. **Niche.** Many **new** / **vacant / different niches** became available.	• Because of mass extinction of fish (lacking the AFGP allele / antifreeze protein).	
S5. **Speciation** of **notothenioids** occurs **/ new species** of **notothenioids** develop / all possess the AFGP gene.	Gives a plausible explanation of how speciation in the notothenioids could have occurred with specific reference to bald notothen and threadfin pithead.	

Q2 Judgement Statements

Mark	Judgement Statement
8	• A logical, coherent answer with minimal irrelevant information and no significant errors • Both patterns identified and justified (P1J and P2J) • 4 Processes (4S) • 6 Justifications (6J: at least 2PJ and 2SJ)
7	
6	• Both patterns identified (P1 and P2) • 3 Processes (3S) • 4 Justifications (4J: at least 1SJ)
5	
4	• 4 relevant ideas • 2 Justifications (2J)
3	
2	• 3 relevant ideas
1	• 1-2 relevant ideas
0	• No relevant ideas

KEY**:**
P = Evolutionary pattern
S = Speciation process
J = Idea justified or elaborated
n / a = not relevant
n / c = not correct
rep = repetition

QUESTION THREE

C	**Competitive advantage** • All Black Walnut adaptations give **greater access to** / **more of / reduce competition** for **named** resource **:** Eg Water, Light, Nutrients, Space • **NB: Not** eliminate / remove competition	**CJ**	**Benefit to Black Walnut** : **Increasing / improving / enhancing;** • growth / reproductive success / health / photosynthetic rate • Survival of Black Walnut **juvenile**

Adaptation (A)	**Justification (J)**	**Competitive advantage (V) (linked to a justification)**
Black Walnut Juveniles • Do not produce Juglone.	**J1.** More energy for **juvenile** growth **J2.** Adult production of juglone provides protection / reduces competition for the juvenile.	• Increased chance of Juvenile survival.
Timing / Location of Juglone production • Juglone is produced in the plant for most of the year. • Juglone is produced in various parts of the plant.	**J3.** Levels remain high in **soil** all year / lasts through winter	• Increased access to / reduced competition for any of: water / nutrients / space / light. **NB: NOT** better growth
Stability of Juglone • Juglone takes 6 months to breakdown. • Juglone not very soluble.		
Leaves • Leaf growth in spring / summer will release large amounts of Juglone. • Decomposition of dead leaves release Juglone into soil. • Leaching of Juglone from leaves release Juglone into soil.	**Reduced:** **J4.** Photosynthesis in Juglone Intolerant plants. **J5.** Growth of Juglone Intolerant plant / named species. **J6.** Growth of Juglone Intolerant roots / shoots. **J7.** Seed germination of Juglone Intolerant plants. **J8.** Seedling growth of Juglone Intolerant plants. **Increased:** **J9.** Soil toxicity / amount of Juglone in soil. **J10.** Large / wide area of soil toxicity.	
Roots • Produce Juglone in summer. • Extensive growth / up to 20m of roots from plant.		
Nuts • Release Juglone in autumn.		
Soil • Highest toxicity of Juglone closest to tree. • Decomposition / leaching of dead leaves / roots release Juglone into soil. • Exudation of Juglone from the roots		

Biodiversity (B)	Justification (B)J
Biodiversity is: Reduced / low / limited. **NB: NOT** changed / affected / negative impact / suffers.	**J1.** Juglone intolerant plants (or named): **decrease** / absent in **number.** **J2.** Animals / herbivores that depend on **Juglone intolerant** plants will **decrease.** **J3.** Carnivores / predators / parasites that depend on these herbivores will **decrease.** **J4.** The food chains / webs are disrupted as they now have fewer links. **J5.** Juglone tolerant plants do not change / **increase** in **number.** **J6.** Animals / herbivores that depend on **Juglone tolerant** plants will **increase** in **number.** **J7.** Carnivores / predators / parasites that depend on these herbivores will **increase.**

	Extent of Control
E1	**Limited Control** • Can control the Juglone intolerant plants **but not** the Juglone tolerant plants (or named species).
E2	**Consumers** • Some control (indirect) over the animals that rely on Juglone intolerant and Juglone tolerant plants.
E3	**Time** • Maintains control throughout the growing season / year: due to slow decomposition of leaves or nuts / slow breakdown of Juglone.
E4	**Juvenile** • **Has no control** as Black Walnut only starts producing Juglone when mature.
E5	**Abiotic Factors** • Cannot control rainfall, sunlight, weather, climate.

Q3 Judgement Statement

Mark	Judgement Statement
8	**A logical, coherent answer with minimal irrelevant information and no significant errors** • Evidence from all 3 areas • 6 Justifications (6J): at least 2 clearly linked to adaptations and 2 from biodiversity • at least 2E
7	
6	• Evidence from all **3 areas** (adaptation / competitive advantage, biodiversity and control) • 4 Justifications (4J): at least 1 from adaptations **and** 1 from biodiversity • at least **1E**
5	
4	• Evidence from 2 areas • 3Justifications (3J): at least one from biodiversity
3	
2	• 3 relevant ideas
1	• 1-2 relevant ideas
0	• No relevant ideas

KEY:

C / V= Competitive advantage
A= Adaptation
B= Biodiversity
E= Extent of control
J= Idea justified or elaborated

n / a= not relevant
n / c= not correct
rep= repetition