Question			Answer	Marks	Guidance
1	(a		**[Level 3]** At least one argument for **and** one argument against is given, to include at least one explanation of the problems of inbreeding. Quality of written communication does not impede communication of the science at this level. **(5–6 marks)** **[Level 2]** At least one argument for **and** one argument against is given **or** one argument for banning given, to include at least one explanation of the problem of inbreeding. Quality of written communication partly impedes communication of the science at this level. **(3–4 marks)** **[Level 1]** One argument for **or** against is given. Quality of written communication impedes communication of the science at this level. **(1–2 marks)** **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. **(0 marks)**	6	**This question is targeted at grades up to A.** **Indicative scientific points at level 3 in addition to points at level 1 and 2 may include:** • (explanation of problem) reduction of gene pool • reduction in variation • accumulation of harmful recessive conditions **Indicative scientific points at level 1, 2 may include:** Arguments for banning breeding: • causes inbreeding • health problems can arise • it is cruel / harmful / unnatural / unethical Arguments against banning breeding: • health problems can be treated • caesarean operations are routine • out-breeding can be used • breeders should be able to do so if they wish / high demand for that breed • breed has been around for hundreds of years / wrong to consign the breed to extinction
	(b)		don't selective breed for large heads / flat faces / narrow hips / selective breeding for smaller heads / less flat faces / avoid breathing problems **/** wider hips / (1) better health care (1)	2	**allow** out-breeding/ORA (1) **allow** dog breeding authorities (eg kennel club) to re-define characteristics of bulldogs (1)
			Total	**8**	

Question			Answer	Marks	Guidance
2	(a		qualitative description of graph which includes two phases (MAX 1) e.g. slow increase at start then rapid increase (1) increase followed by decline(1) correct reference to any quantitative description of graph (1)	2	 example between 1 -9 hours increase, 5 to 6 hours rapid increase (2)
	(b)		**any three from:** identify / select gene (antigens) for human tissue types (1) isolate (this) gene / the gene (for human tissue type) (1) insert / splice (this) gene into the pig embryo / gamete (egg cell) (1) replicate gene(s) / cells (1) check cells for expression of gene (1)	3	**responses must relate to pigs and humans** **allow** identify anti-rejection gene **allow** extract this gene **ignore** insert nucleus **allow** put this gene into the pig embryo / embryo DNA

Question			Answer	Marks	Guidance
	(c)		**any two from:** any correctly matched pro or con with relevant argument (1) shows an understanding of the **idea** that there will be pros and cons for this type of research (1) government needs to make a decision that is the best outcome for most people / ie benefits outweigh the risks for the majority of people (1)	2	**arguments against this research:** it is creating an artificial situation that would not occur naturally unsure of the consequences of using another mammal's organs inside humans may consider it unethical / morally unsuitable to put another organism's organs into a human may consider it against their religious conviction **arguments for this research:** will mean benefit of reducing donor shortage help to save human life that could be saved but for lack of donors future medical advances could stem from this research health costs will be reduced as more people will benefit and need less expensive treatment / fewer anti-rejection drugs needed
			Total	**7**	

Question	Answer	Marks	Guidance
3 a	**enzyme** / **use of the enzyme** sucrase lactase ligase Used in the production of lactose free milk Used on reagent strips to detects lactose Joins strands of DNA together Used to produce sweeter sugars for food	2	three correct =2 marks one or two correct = 1 mark if 2 lines from one enzyme, then do not credit for that enzyme
b i	protein (1)	1	**allow** polypeptides **not** amino acids
ii	idea that claim can not be quantified (1) people's taste differs / it's just an opinion / it's subjective (1)	2	**allow** it is only a claim / not scientific fact / cannot be proved / there is no evidence
iii	plasmid (1)	1	**allow** virus **allow** loop of DNA
	Total	**6**	

Question			Answer	Marks	Guidance
4	(a)		30 (1)	1	
	(b)		this is selective breeding / artificial selection (1) which leads to inbreeding (1) idea that lameness / diarrhoea are genetically controlled (1)	3	**ignore** just lameness / diarrhoea are passed down additional marking points: **allow** higher level response: reduced gene pool / reduction in variation / accumulation of harmful recessive characteristics (1) BUT there is no variation
	(c)	(i)	(most) animal (cells) lose the ability to **differentiate** (at an early age) OR (many) plant (cells) retain the ability to differentiate (throughout their lives) (1)	1	**allow** plants retain stem cells but animals do not
		(ii)	**any three from** other scientists can **build upon** their results (1) so can develop ideas **quicker** (1) other scientists can **repeat / test** the work (for validity) (1) different teams have **different** skills / resources / ideas / approaches (1) so that a broad **range of evidence** can be put together to develop the idea (1)	3	**allow** work continues even if some people are absent **allow** can share out work load **allow** can do more work **allow** can bounce ideas off each other **allow** able to get variety of results to solve a problem **allow** to gather more evidence to justify ideas
			Total	**8**	