Question	Answer	Marks	Additional Guidance
1 **(b) (i)**	lag (phase); log / exponential (phase); stationary / plateau (phase); death (phase);	**4**	
(ii)	no longer reproducing / death rate greater than or equal to 'birth' rate; ref to <u>limit</u>ing factor(s); no / less, (named) nutrients; no / less, space; no / less, oxygen; build-up of (named) waste; waste is toxic; idea that pH could change to be unsuitable;	**max 2**	**A** reached carrying capacity **A** lactose / sugar / glucose / salts / minerals e.g. carbon dioxide / lactic acid
(c)	increase in, size / length / mass / volume / AW; increase in <u>dry</u> mass; increase in <u>cell</u> number; ref to permanent;	**max 2**	**note:** increase in dry mass = 2 marks **A** ref to cell division / mitosis / reproduction of cells / tissues **R** reproduction unqualified **I** development
(d)	asexual (reproduction) / binary fission;	**max 1**	**R** mitosis

1	(e)	advantages: longer shelf-life / stop foods going off; stop / reduce, growth of (unwanted) bacteria / fungi / microbes; prevent food poisoning; improve / give, taste / flavor; give colour / improve appearance; give texture; emulsify / stabilise, food components; disadvantages: hyperactivity (in children); allergies; vomiting / nausea / headache; asthma; possible link with cancer; AVP;		advantages to max 3 **A** reproduction / multiplication / AW disadvantages to max 3
			max 4	
			[Total: 15]	

Question	Answer	Marks	Additional Guidance
2 (a (i)	**X** – protein (coat / AW) / capsid / capsomere(s); **Y** – genetic material / nucleic acid / RNA;	**2**	**A** DNA / gene(s) **R** nuclear material / chromosome
(ii)	cell wall; cell membrane; cytoplasm; loop of DNA; (slime) capsule; flagellum / flagella; plasmids; ribosome(s); AVP;	**max 3**	**R** cellulose cell wall **I** size / complexity / shape e.g. pi
(b) (i)	number of people living with HIV: numbers living with HIV increased (from 1990), levelled off / increased slightly, from 2000 / 2001 / 2002; any one correct data quote from vertical axis for numbers living with HIV; number of people newly infected with HIV: numbers newly infected increased (and levelled off between 1994 and 1998) **and** decreased since, 1997 / 1998; any one correct data quote from vertical axis for numbers newly infected with HIV;	**4**	date quotes must have correct year, but **A** 'starts' for 1990 and 'ends' for 2009 / 2010 **A** any correct manipulation of the data, e.g. increased by / percentage increase, etc. **A** ± ½ a square for data quotes

2	(ii)	people living with HIV are living longer; success of (named) treatment for HIV / AIDS; success in reducing transmission; reference to, education / information / funding, about HIV / AIDS;	**max 2**	e.g. drugs / antivirals / AZT / nursing care **A** ref. to barrier contraception / condom / femidom
	(iii)	from mother to fetus / across the placenta; from mother to baby at birth; in breast milk; unprotected / unsafe sex; sharing, needles / syringes; in blood products / blood for transfusion / transplants / blood to blood contact; AVP;	**max 3**	**R** saliva **R** other sharps, e.g. razors unless qualified by blood contact **R** using contaminated / dirty / used, needles unqualified **A** intravenous drug use / AW **R** donating blood **R** blood unqualified **A** 'blood exchange' **I** body fluids unqualified
	(iv)	weakens the immune system / reduces capacity of body to respond to disease / AW; <u>lymphocytes</u> are, damaged / destroyed / killed / not functional; (B / T) lymphocytes / white blood cells, stop making antibodies; any **two** roles of antibodies or lymphocytes or phagocytes which will not happen or not happen very well;;	**max 3**	**R** 'no immune system' / 'destroys immune system' **A** 'fight' disease antibodies stop, pathogens spreading (in the body) antibodies cause pathogens to, clump / agglutinate antibodies kill bacteria antibodies make it easier for phagocytes to ingest pathogens antibodies, neutralise toxin(s) / make toxins harmless phagocytes, ingest / AW, pathogens lymphocytes kill infected cells
			[Total: 17]	

		Answers	Marks	Guidance for Examiners
3 **(a)**	**1**	(red blood cells) get stuck in capillaries / do not flow smoothly / capillaries blocked**;**		**ignore** less haemoglobin
	2	reduce , supply of, oxygen / nutrients (to tissues / cells / muscles) **;**		**A** carries <u>less</u> oxygen / nutrients…
	3	reduce , removal of, carbon dioxide / wastes, (from tissues / cells / muscles) **;**		**A** carries <u>less</u> carbon dioxide…
	4	ref to respiration (in tissues) **;**		
	5	cause sickle cell crises **;**		
	6	pain **;**		
	7	increased chance of, thrombosis / blood clotting **;**		
	8	death of tissues / cells **;**		
	9	AVP **;**	**[max 4]**	**I** reduced life expectancy
(b) (i)	allele(s) **;**		**[1**	
(ii)	H^A , H^S + H^A , H^S **;**			Could be in Punnett square **A** just A and S
	$(H^A H^A$, $H^A H^S$, $H^A H^S)$ $\underline{H^S H^S}$ **;**	**[2]**	**A** just S and S
(iii)	0.25 / 25 % / ¼ / 1 in 4 **;**	**[1**	**I** ratios

		Answers		Guidance for Examiners
3 **(c) (i)**	**1**	malaria, is severe disease / may be fatal ;		**A** sickle cell trait / carrier for H^SH^A throughout the answer
	2	*idea that it is the* selective agent / ref to natural selection ;		
	3	H^AH^A / homozygous dominant, susceptible to malaria ;		
	4	H^AH^S / heterozygous, resistant ; **A** H^SH^S resistant ;		
	5	H^AH^S survive / H^AH^A more likely to die before have children ;		**R** immune
	6	H^AH^S have children and pass on, the allele / H^S ;		
	7	(if H^AH^S x H^AH^S) 1 in 4 chance of, H^SH^S / homozygous recessive ;		
	8	2 in 4 / ½ , have advantage of resistance to malaria ;		
	9	AVP ; e.g. ref to malarial parasite /		
	10	AVP ; e.g. ref to transmission of malaria	**[max 4]**	
(ii)	**1**	malaria not very serious / not a severe strain of malaria ;		
	2	people have other genetic protection from malaria ;		E.g. Thalassem
	3	malaria has only recently spread to these areas / no malaria before;		
	4	mutation not occurred in populations of these areas ;		
	5	people with mutation / have sickle cell allele , have not migrated here ;		**A** mutation described **I** gene, for allele
	6	(majority of) population in Australia has not lived there for long ;		
	7	came from areas where no malaria, is / was, present ;		
	8	AVP ;		
	9	AVP ;	**[max 2]**	
			[Total:14]	