

Question		Answers	Marks	Additional Guidance	
1	(a)	<p><i>water jacket</i></p> <p>1 maintain optimum / constant temperature ; 2 to prevent <u>enzymes</u> denaturing ; 3 loss of shape / ref. to active site ; 4 (because as) fungus respire ; 5 releases heat ; 6 so temperature in the fermenter increases ; 7 which would kill fungus ; 8 (therefore) no, product / penicillin / AW ;</p>	max 4	<p>A prevent overheating R fungus denatures</p> <p>MP 6 must be linked to MP4 or 5</p>	
		<p>9 <i>addition of acids and alkalis</i> maintains pH / keeps pH constant ; 10 <u>enzymes</u> need optimum pH ; 11 (otherwise) enzyme activity / rate of reaction, slows ; 12 to give maximum yield / AW</p>	max 3 = max 6	<p>R to maintain neutral pH</p> <p>R fungus needs optimum pH A stop enzymes denaturing</p>	
	(b)	(i)	40–50 / 40–60 / 40–80 ;	1	R 40–45 / 50–60 / 60–80
		(ii)	mitosis ;	1	
		(iii)	<p>1 nutrients are used up ; 2 <u>limiting</u> (factors) ; 3 explanation of limiting factor ; 4 waste products accumulate ; 5 wastes are toxic ; 6 penicillin could inhibit growth ; 7 population reaches carrying capacity ; 8 AVP ;</p>	max 3	<p>A food</p> <p>A factor in shortest supply / AW</p>

Question		E	Answers	Marks	Additional Guidance
1	(c)	(i)	fungus grows when no penicillin produced ; during first 20 hours ; only nutrients and fungus added at the beginning / no penicillin added ;	max 2	
		(ii)	penicillin production stopped / no more penicillin produced ;	1	accept yield stays the same
	(d)		purifying / separating, penicillin ; from, waste / toxins / AW ; concentration ; making into, pills / packaging / AW ; AVP ; e.g. colour / taste	max 3	R 'make into a medicine'
	(e)		viruses are not cells ; viruses have no metabolism ; <i>idea that viruses have no target for antibiotics ;</i> antibiotics stop cell wall growth ; viruses have no cell wall ; antibiotics stop enzymes working ;	max 2	ignore 'viruses are not alive' A viruses do not have ribosomes A viruses have no enzymes
				[Total: 19]	

Question	E	Answers	Marks	Additional Guidance
2 (a)	1 2 3 4 5 6	enter, blood / plasma / lymph ; infect / enter, white blood cell / lymphocyte / phagocyte / AW ; infect, brain / liver / lungs / skin / reproductive system / kidney / gut ; cannot reproduce ; may be transmitted to another person ; e.g. of method of transmission ; R excreted, die	[max 2]	A ref. to antibodies combining with virus A 'attack' / 'invade' white blood cells A 'attack' / 'invade' / enter MP6 A sexual intercourse / in blood / in breast milk / across placenta / needle stab
(b)	1 2 3 4 5 6 7 8 9 10	infects / destroys / kills, phagocytes ; destroys / kills / disables, <u>lymphocytes</u> ; fewer antibodies produced ; ref. to, T lymphocytes / T cells ; slow / no / weaker, immune response / response by immune system ; <i>idea of increased susceptibility to</i> disease / infection / (named) pathogens ; A viruses / bacteria cancers ; fungal infections / TB / pneumonia / named disease linked with HIV ; R common cold develop AIDS ; AVP ;	[max 3]	A no phagocytosis A fewer lymphocytes R 'attacks' / 'damages' A 'immune system not working' A suppresses / damages, immune system A 'can't fight disease' MP3–8 A <i>answers that give role(s) of immune system followed by 'this doesn't happen'</i>
(c) (i)		(substance) changes / modifies / affects, (chemical) reactions in the body / how the body works ;	[1]	I category of drug, medicine, specific effects of named drug, etc.
(ii)		<i>antibiotics</i> if 'antibodies' written rather than antibiotic – mark to max 1 are not effective against viruses / only effective against bacteria ; <i>idea that</i> nothing for them to act on ; e.g. cell wall / protein synthesis / cellular structure / capsule	[2]	I viruses inside cells A do not work against viruses A ORA R 'life processes'
			[Total: 8]	

Question	Answer	Mark	Additional Guidance
3 (a) (i)	<i>glucose</i> provides energy / required for (aerobic / anaerobic) respiration ; <i>amino acids</i> used, to make (named), proteins / polypeptides ;	[2]	R to produce / AW, energy A for (cell) growth / make new cytoplasm
	(ii) DNA / chromosome / genetic material, replicates / is copied ; cell membrane / cell wall, develops in the middle of the cell ; binary fission ; bacteria / cell / cytoplasm, divides into two ;	max [2]	ignore mitosis / RNA / chromosomes
(b)	some bacteria were resistant to antibiotic, S / T / both S and T ; fewer were resistant to antibiotic T / antibiotic T is more effective (than S) ; both antibiotics, killed / inhibited growth or reproduction of, (susceptible) bacteria ;	max [2]	R immune / antibodies
(c)	bacteria are resistant ; have reproduced / multiplied, (in culture) ; all genetically identical, so all resistant ;	max [2]	R 'growing / becoming, resistant'

<p>3 (d)</p>	<p><i>antibiotic resistant bacteria are formed by</i> mutation ; change to, DNA/gene ; produces, new/different, protein ; ref to anything that increases risk of resistance ;</p> <p><i>spread</i> (when antibiotic is used) susceptible/AW, bacteria die ; ORA less competition/example ;</p> <p>ref to fewer limiting factor(s) ; resistant bacteria, reproduce/multiply ; pass on their (DNA/gene(s)/allele(s)) for (antibiotic) resistance ; ref to, (unprotected) sexual intercourse/many sex partners/AW ; any two methods of transmission (from host to host) ;;</p> <p>AVP ;</p>	<p>max [5]</p>	<p>e.g. not completing the full course /do or taking antibiotics when not necessary</p> <p>e.g. more food/resources (available for resistant bacteria)</p> <p>e.g. body fluids/droplets (in air)/blood/needles or syringes/food/water/(named) vector/across placenta/at birth/breast milk</p>
		<p>[Total: 13]</p>	

Question		Answers	Marks	Additional Guidance
4	(a)	<u>arthropods/Arthropoda</u> ;	[1]	R 'anthropod'
	(b)	<p>A – spiny/oval, carapace/AW ; jagged edge of carapace ; claws same length ; eyes on (short) stalks ;</p> <p>B – long/coiled/soft , abdomen ; abdomen not under carapace ; (long) antennae ; multiple, appendages/mouth parts ; <u>shorter</u> back (walking) legs ; uneven length of, chelipeds/claws/pincer ; hair on claws ; eyes on stalks ;</p> <p>C – uneven length of, chelipeds/claws/pincers ; square/rectangular, carapace ; eyes on (long) stalks ;</p> <p>D – rounded/flattened/less hairy, back/hind (walking) legs ; <u>longer/wider</u> back (walking) legs (compared to other legs) ; jagged edge on claws ; jagged/pointed edge, of carapace ; short antennae ; no eye stalks ; claws same length ;</p>	[4]	<p>A descriptions of carapace/back/'shell' ignore <u>exoskeleton</u> for carapace</p> <p>ignore 'tail' for abdomen ignore segmented abdomen</p> <p>ignore clamp ignore fur for hair</p> <p>A <u>larger/bigger</u> as BOD (for hind legs)</p>

Question			Answers	Marks	Additional Guidance
4	(c)	(i)	mass ; size of a named suitable feature ; length of named suitable feature ; width of named suitable feature; number of hairs ; number of spikes/roughness ; thickness of a suitable named feature ; hardness of a suitable named feature ; depth of colour ;	[max 1]	<i>features qualified in (c)(ii) may be credited in (c)(i)</i> R number of anything absolute (e.g. legs) R shape unqualified R colour unqualified R fur ignore comparing species rather than individuals
		(ii)	balance/weighing machine/scales ; use of ruler described ; calipers ; any other suitable method for the feature given in (i) ;	[max 1]	ignore measure unqualified No ECF from (c)(i)
1	(d)	1 2 3 4, 5 6 7	population remains the same if birth rate = death rate/ref to carrying capacity ; death rate must be high ; many young crabs do not survive to, adulthood/breed ; example of cause of high death rate ;; lack of/competition for, food ; ref to <u>limiting factor</u> (s) ;	[max 3]	<i>examples of MP4 and MP5</i> eaten by predators competition with other crabs (of the same species/other species) competition with other non-crab species (infectious) disease effect of abiotic factor (e.g. dehydration) indirect effect of man, e.g. pollution/habitat destruction genetic disease/genetic 'fault' fishing/crabbing

4	(e)	<p>1 stops/reduces, blood loss/bleeding ;</p> <p>2 reduce (bacterial) infection/bacteria killed in wound ;</p> <p>3 (clotting) prevents entry of pathogens ;</p> <p>4 more <u>red</u> blood cells, trapped in mesh/fibrin (forming a clot/scab) ;</p> <p>5 promotes healing ;</p> <p>6 (in an emergency) may need wound to be sealed quickly ;</p> <p>7 less chance of allergies ;</p>	[max 3]	<p>ignore bandages help quicker clotting</p> <p>R <u>viral</u> infections</p>
			[Total: 13]	