1)

(a)	(i)	B <u>and</u> C ;		1	Both need to be given for the mark to be awarded. DO NOT CREDIT if A also given.
(a)	(ii)	(involved) after , pathogen / AW , has entered the body ;		1	IGNORE ref to primary defence without the clear idea that the pathogen has <u>entered the body</u> IGNORE refs to mechanisms of action, e.g. 'phagocytes do not make antibodies' ACCEPT attacking foreign bodies after they have <u>passed through</u> the skin
(a)	(iii)	(phagocytes) able to, digest / break down / engulf / target / deal with, a range of / many different , pathogens ; ora		1	ACCEPT bacteria or virus as synonym for pathogen if the idea of a variety is clearly present ACCEPT phagocytes can break down *any* pathogen ACCEPT phagocytes do not have (antigen-)specific receptors IGNORE phagocytes do not make memory cells IGNORE antigen if used as synonym for pathogen
(a)	(iv)	1	lobed / narrow , nucleus ;	2	
		2	(cells) can change shape ;		2 ACCEPT in context of cell or nucleus 2 ACCEPT cells , are plastic / have flexible structure / have flexible membrane 2 IGNORE squashable / stretch
		3	can squeeze / move / fit / AW , between cells / through pores , in (walls of) capillaries ;		3 ACCEPT holes / gaps / fenestrations
		4	histamine makes , capillary walls / endothelium , leaky ;		
(a)	(v)			6	ACCEPT phonetic spellings throughout
		1	(pathogen) engulfed / enveloped / surrounded by cytoplasm (from phagocyte) ;		1 ACCEPT 'pseudopodia / cytoplasm / cell membrane , extend from phagocyte' 1 DO NOT CREDIT eaten. ACCEPT ingested
		2	<u>endocytosis</u> / <u>phagocytosis</u> ;		
		3	(formation of) <u>phagosome</u> / phagocytic vacuole / <u>phago</u>cytic vesicle ;		3 CREDIT in correct context only
		4	(phago) <u>lysosomes</u> ;		
		5	(lysosomes / phagosome) move towards / fuse with (each other) ;		5 ACCEPT attracted to / joins
		6	(named) enzyme(s) / lysins / hydrogen peroxide / free radicals (in lysosomes) ;		
		7	(pathogen) digested / broken down / hydrolysed ;		7 IGNORE destroyed / broken up / killed
		8	(to) amino acid / sugar / glucose / fatty acid / glycerol ;		
		9	(break down products) absorbed / AW (into cytoplasm) or unwanted products removed (by exocytosis) ;		9 IGNORE refs to antigen presentation 9 ACCEPT enter cytoplasm
		10	cytoskeleton involved in (endocytosis / movement of vesicles) ;		
			QWC key points in sequence ;	1	Award if the following mark points have been awarded: mp 1 or 2 followed by mp 6 or 7
(b)	(i)	*Mycobacterium* /*M. tuberculosis* / *M. bovis* ;		1	ACCEPT phonetic spellings IGNORE case of initial letter No need to underline
(b)	(ii)	<u>droplets</u> (containing pathogen) ; (released by) coughing / sneezing ; inhaled by (uninfected) , individual / AW ;		2	IGNORE airborne IGNORE laughing / talking / kissing / breathed out

(c)	(i)			3	Mark points 1-5 cannot be inferred from figures
		1	in both years incidence (of TB) , decreases / AW , as income , increases / AW ; ora		1 ACCEPT 'incidence is higher in low income group and lower in high income group, in both years / always'
		2	no change in, low / lower middle, (income groups) ;		
		3	increase in upper middle (income group) ;		3 ACCEPT upper middle less in 2000
		4	decrease in high (income group) ;		4 ACCEPT high (group) more in 2000
		5	idea of overall very little change between 2000 and 2008 ;		
		6	calculated difference in figures with units to support points 3 to 5 ;		6 ACCEPT any increase or decrease e.g., high group has gone down by 3 per 100000 6 ACCEPT also • 10% increase in upper middle group • 17.6% / 18% , decrease in high income group • 1% / 1.3% , increase overall • high income group in 2008 is , 82.4% / 82% / 0.824 / 0.82 , of original value 6 IGNORE 0% increase in low / lower middle income groups There is no need to refer to years as only 2 are shown

(c)	(ii)			3	IGNORE prompt lines and mark as prose
		1	overcrowded / AW (living space) ;		1 ACCEPT cramped
		2	poorly ventilated (living space) ;		
		3	poor diet / malnourished ;		
		4	poor health ;		4 ACCEPT poor immune system 4 IGNORE hygiene / standard of living
		5	homelessness ;		
		6	idea that more likely to consume , meat / milk, from infected cattle ;		
		7	idea of vaccination / medical treatment , more difficult to access ;		7 CREDIT healthcare more expensive 7 ACCEPT poor healthcare 7 IGNORE less aware of the risks
			Total	21	

2)

(a)	(i)					3	Award 3 marks for the correct answer (0.6366)

species	number of individuals (n)	n/N	(n/N)²
Dog's mercury	40	0.40	0.1600
Wild strawberry	13	0.13	0.0169
Common avens	43	0.43	0.1849
Wood sorrel	4	0.04	0.0016
	N = 100		$\Sigma(n/N)^2$ = 0.3634
			$1-(\Sigma(n/N)^2)$ = 0.6366 ;;;

If answer is incorrect:

IGNORE numbers in first 4 rows

'N = 100' = 1 mark

$\Sigma(n/N)^2$
ALLOW ecf for correct calculation from candidate's incorrect N value

$1-(\Sigma(n/N)^2)$
ALLOW ecf for correct calculation from candidate's $\Sigma(n/N)^2$ value

Answer must be given to 4 dp for ecf

(a)	(ii)	species richness number of species (in an area / habitat) ; species evenness number of / how many, individuals there are of, each / every, species (in an area / habitat) ;	2	IGNORE organisms / abundance / quantity / variety DO NOT CREDIT amount ACCEPT 'organisms' as AW for individuals CREDIT relative abundance of (each) species / population size of each species IGNORE relative abundance of, a / one, species DO NOT CREDIT amount

Question		Answer	Marks	Guidance
(a)	(iii)	(habitat) dominated by, one / few / AW, species ; change in one species , likely to affect whole habitat / AW ; community / ecosystem / habitat / area , is unstable / not able to withstand change / easily damaged ;	2	ACCEPT high number of one species IGNORE environment / biodiversity as AW for community IGNORE the community / AW will be damaged

(b)				2	IGNORE prompt lines and mark as prose
		1	*idea of* random sampling ;		1 ACCEPT description of randomisation method
		2	standardisation of technique ;		2 ACCEPT description of standardisation method 2 ACCEPT count the same way each time
		3	use of, key/identification chart ;		
		4	survey at different , times of year / season ;		4 IGNORE 'repeat' unqualified 4 IGNORE different times of day / different times
		5	include , trees / species larger than quadrat ;		

3)

(a)	(i)		2	IGNORE amount throughout ACCEPT a combination of species richness and species evenness ACCEPT abundance IGNORE organisms
		range / variety / number , of species (in an area) ;		
		range / variety of, habitats / ecosystems ;		ACCEPT number of habitats
		variety of , alleles / genes ;		

(a)	(ii)			2	IGNORE prompt lines and any reference to biodiversity CREDIT a correct response anywhere in the answer IGNORE unspecified refs to ethical, aesthetic or economic
		1	part of (local) food , chain / web ;		1 ACCEPT keystone species
		2	tourism ;		
		3	native species / *idea of* heritage of the area ;		3 ACCEPT native to UK
		4	to protect a neighbouring red squirrel population ;		
		5	*idea that* Northumberland red squirrel population is nationally significant ;		5 e.g. Northumberland has significant proportion of total population so loss of this population might jeopardise all British squirrels IGNORE refs to genetic resource as no suggestion that this population is distinct from red squirrels elsewhere.

(a)	(iii)	*idea that:*	1	
		it is wrong to interfere with nature ;		ACCEPT qualified refs to , moral / ethical / religious , reasons IGNORE it's wrong to play God
		it is wrong to kill animals ;		ACCEPT it is cruel
		grey has (as much) right to live <u>there</u> (as red) ; *idea that* might be useful in the future / enjoyed by future generations ; grey will be part of food chain ;		

(b)				2	IGNORE prompt lines and mark as prose CREDIT correct response where seen
			idea that:		
		1	harder to see ; ora		1 ACCEPT 'they remain hidden'. IGNORE 'they may be hiding'
		2	(harder to see because) more timid / frightened of people / spend less time on ground / smaller ; ora		2 IGNORE 'they may be hiding'
		3	species may be wrongly identified ;		
		4	grey squirrels more likely to visit gardens / parks / public areas ; ora		
		5	people are more inclined to report grey sightings ; ora		
		6	AVP : ora		6 ACCEPT grey squirrels might be less camouflaged (so easier to see) 6 ACCEPT red squirrels might be (more) nocturnal / AW 6 IGNORE squirrel species hard to distinguish / same individual counted more than once

(c)				3	IGNORE prompt lines and mark as prose IGNORE refs to benefits of development Answers should be given in terms of assessing aspects of the development.
		1	size (of development) ;		1 ACCEPT 'how big will it be?'
		2	*idea of* environmental sensitivity / which species present / which habitats present , in the area ;		2 ACCEPT e.g. 'what lives there?' / 'whether a rare species live there' 'whether red squirrels live there' / 'the biodiversity of the area' / is it an SSSI? / species richness
		3	potential damage (to area / organisms) ;		3 ACCEPT e.g. 'how much damage will it do?' / effect on ecosystem / how much it would be destroyed / how many organisms will it kill?
		4	*idea of* potential strategies to minimise impact ;		4 ACCEPT e.g. 'what can be done about it?' / possible change to reduce impact 4 Must be a general statement 4 IGNORE stated example without the general idea

4)

(a)	(i)		*idea of* if one susceptible to, this / the disease, all likely to be ;	1	DO NOT CREDIT if the response is referring to diseases in general
(a)	(ii)	1	environment / environmental factor ;	2	
		2	(variation in) weather conditions / temperature ;		2 ACCEPT climate
		3	rainfall / soil water content ;		3 IGNORE 'availability of water' unqualified
		4	soil , (named) mineral / nitrate , content / AW ;		4 IGNORE nutrient 4 ACCEPT mineral availability / amount of fertiliser added
		5	(named) biotic factor (might vary) ;		5 e.g. number of pests / competition from other plants / disease
(a)	(iii)		mutation ;	1	ACCEPT deletion etc. IGNORE (named) mutagenic agent

			Answer	Marks	Guidance
(b)				6	If a candidate describes resistance as immunity DO NOT CREDIT the first time it is seen but apply ECF thereafter
		1	cross / breed, with disease resistant variety ;		1 ACCEPT make two disease resistant individuals reproduce 1 IGNORE crossbreed two best individuals
		2	method to test offspring for disease resistance ;		2 ACCEPT general statement or example e.g: 'germinate seeds, expose to disease, see if die'
		3	select , best offspring / offspring with resistance ;		3 ACCEPT seeds / tubers / potatoes 3 IGNORE children / babies
		4	(inter)breed, offspring with resistance / best offspring ;		
		5	(continue process) for (many) generations ;		5 IGNORE many years
		6	*idea of* avoid breeding, closely related / AW , individuals to preserve genetic diversity ; ora		6 ACCEPT avoid , inbreeding / inline breeding 6 ACCEPT 'maintain genetic diversity by breeding with plants from different field / area' 6 ACCEPT breed with different varieties to widen the gene pool
		7	(regularly back) cross with, wild variety ;		
		8	*idea of* preserving rare varieties in case they are needed in the future ;		8 ACCEPT use of seed bank to preserve range of alleles
		9	AVP ;		9 e.g, ref. to marker assisted selection / detail of pollination method / prevention of self-pollination / asexual reproduction of desired variety
		QWC ;		1	Award if the answer has been given one mark from marking points 1–5 and one mark from marking points 6–8

5)

(a)				5	Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT phonetic spellings
	1	*Echiniscus* ;			1 Initial letter must be upper case
	2	order ;			2 ACCEPT super family / epifamily
	3	phylum ;			
	4	Animalia ;			4 ACCEPT animals 4 IGNORE case of initial letter
	5	Eukaryota ;			5 ACCEPT eukaryotes / Eukarya / eukaryotic 5 IGNORE case of initial letter
(b)	1	(phylogeny is) evolutionary relationships (between organisms) ;		3	1 IGNORE 'evolution' without further qualification 1&2 phylogeny is the closeness of evolutionary relationships = 2 marks 1 ACCEPT phylogeny is evolutionary history
	2	(phylogeny is study of) closeness of (evolutionary) relationships ;			
	3	phylogeny is basis of / used in , natural / scientific / modern, classification ;			3 ACCEPT new 3 IGNORE related to classification
	4	*idea that* the closer the (evolutionary or genetic) relationship the closer the (taxonomic) grouping ;			4 ACCEPT ref to recent common ancestors as AW for close relationship 4 ACCEPT named taxonomic group for 'grouping' 4 ACCEPT 'if the DNA is very different then the group is not the same'
	5	correct use of example ;			5 e.g. gorillas and chimpanzees (closely grouped)

uestion		Answer	Marks	Guidance
(c)		too small to see ;	2	'can only be seen under microscope' = 1 mark (mp1) IGNORE 'can't see it' without the idea of size, e.g. can't see it clearly = 0 marks, can't see its features = 0 marks ACCEPT implication of being too small to see, e.g. 'you need a microscope to see them' = mp1 'people couldn't see them in the past because we didn't have microscopes' = 2marks (mp1 and mp2)
		(unable to see them) until invention of microscope / development of suitable viewing apparatus / AW ;		IGNORE type of microscope if stated ACCEPT 'magnifying glass'
		only 0.3mm in length ;		ACCEPT ± 0.1 mm
			Total 10	

6)

(a)		low / small, surface area to volume ratio ;	3 max	**Mark the first 3 suggestions** CREDIT SA/Vol, SA:Vol ACCEPT surface area to volume (ie if 'ratio' missed) IGNORE lower SA / Vol
		diffusion, too slow / distance too great ;		ACCEPT diffusion pathway too long ACCEPT diffusion insufficient because, body too large / tissues too deep
		to supply enough, oxygen / (named) nutrients ;		ACCEPT 'transport enough' for 'supply enough' idea of 'enough' is important
		to prevent, CO_2 / (named) waste product, building up ;		ACCEPT to remove waste products ACCEPT to prevent waste reaching toxic levels
		active ;		ACCEPT high demand for oxygen / energy OR high metabolic rate OR endotherm / maintaining temperature / exercising
(b)	(i)		1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
		electrocardiogram ;		IGNORE ECG DO NOT CREDIT electrocardiograph
	(ii)		2	Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
		A sinoatrial node / SAN ; B atrioventricular node / AVN ;		sinalatrial node / sanatrial node = NBOD atroventricular / atrialventricular, node= BOD artrialventricular / avioventricular node = NBOD
(c)	(i)	(to allow time) for the atria to (fully) contract ; to allow (time for), atria to empty / blood to move / ventricles to fill ; so that ventricle(s) do not contract, too early ;	2 max	ACCEPT systole for contraction IGNORE pumping ACCEPT so atria and ventricles do not contract at the same time ACCEPT (atria contract) before ventricular systole occurs **Note:** so ventricles do not contract before they are full = 2 so ventricles do not contract before atria are empty = 2 so atria have time to empty before the ventricles start to contract = 2
	(ii)		2 max	IGNORE ref to gravity / ref to blood pressure
		so that (ventricular) contraction starts at, apex / base / bottom ;		ACCEPT systole for contraction ACCEPT contract from the apex IGNORE pumping
		to push blood upwards OR into/ towards, (named) arteries ;		
		complete / efficient, emptying of ventricles ;		ACCEPT force all blood out of heart