

Question number	Answer	Mark	Guidance																								
Application 1 (a)	A disease that can be passed from one organism to another, either directly from one organism to another by some mechanism or indirectly e.g., via wind, water or an animal																										
1 (b)	<p>Any sensible points, for example:</p> <table border="1" data-bbox="320 488 1074 1653"> <thead> <tr> <th data-bbox="320 488 587 589"><i>Spirometra erinaceieuropaei</i></th> <th data-bbox="587 488 831 589">TB</th> <th data-bbox="831 488 1074 589">HIV/AIDS</th> </tr> </thead> <tbody> <tr> <td data-bbox="320 589 587 689">Communicable disease</td> <td data-bbox="587 589 831 689">Communicable disease</td> <td data-bbox="831 589 1074 689">Communicable disease</td> </tr> <tr> <td data-bbox="320 689 587 813">Can affect the brain and other tissues</td> <td data-bbox="587 689 831 813">Can affect the brain and other tissues</td> <td data-bbox="831 689 1074 813">Can affect the brain and other tissues</td> </tr> <tr> <td data-bbox="320 813 587 891">Tapeworm</td> <td data-bbox="587 813 831 891">Bacteria</td> <td data-bbox="831 813 1074 891">Virus</td> </tr> <tr> <td data-bbox="320 891 587 1171">Rare in people, found in crustacea, reptiles, amphibian, and mammals such as cats and dogs</td> <td data-bbox="587 891 831 1171">Common in people, also in other mammals including cows, badgers, and deer</td> <td data-bbox="831 891 1074 1171">Common in people, rare in other species except for some apes.</td> </tr> <tr> <td data-bbox="320 1171 587 1339">Probably treatable by anti-helminthic medicine</td> <td data-bbox="587 1171 831 1339">Treatable by antibiotics</td> <td data-bbox="831 1171 1074 1339">Cannot be cured – can be managed using anti-virals etc</td> </tr> <tr> <td data-bbox="320 1339 587 1417">No vaccine</td> <td data-bbox="587 1339 831 1417">Vaccine</td> <td data-bbox="831 1339 1074 1417">No vaccine</td> </tr> <tr> <td data-bbox="320 1417 587 1653">Infection by eating raw infected meat, eye contact with raw infected tissues</td> <td data-bbox="587 1417 831 1653">Droplet infection</td> <td data-bbox="831 1417 1074 1653">Direct transmission via body fluids</td> </tr> </tbody> </table>	<i>Spirometra erinaceieuropaei</i>	TB	HIV/AIDS	Communicable disease	Communicable disease	Communicable disease	Can affect the brain and other tissues	Can affect the brain and other tissues	Can affect the brain and other tissues	Tapeworm	Bacteria	Virus	Rare in people, found in crustacea, reptiles, amphibian, and mammals such as cats and dogs	Common in people, also in other mammals including cows, badgers, and deer	Common in people, rare in other species except for some apes.	Probably treatable by anti-helminthic medicine	Treatable by antibiotics	Cannot be cured – can be managed using anti-virals etc	No vaccine	Vaccine	No vaccine	Infection by eating raw infected meat, eye contact with raw infected tissues	Droplet infection	Direct transmission via body fluids		
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1 (c)	<p>A localised non-specific response to the presence of pathogens – mast cells activated if tissue damaged release histamines and cytokines, histamines increase blood flow and cause oedema (swelling) and pain, cytokines attract phagocytes to destroy a pathogen.</p> <p><i>Suggestion:</i> As tapeworm moved across brain, localised inflammatory response would affect the working of that area</p>																										

	of the brain and cause changing symptoms.		
2 (a)	<p>Examination of observable features including under a microscope</p> <p>Comparision of proteins e.g., by chromatography, gel electrophoresis</p> <p>DAN (genome) sequencing</p>		
2 (b)	<p><i>Natural selection:</i> organisms within a species show variation in their characteristics. This variation is caused by differences in the alleles of their genes – genetic variation. Mutation also introduces variation, creating a new version of an allele.</p> <p>Predation, competition (for mates and resources) and disease cause a struggle for survival. The organisms whose characteristics are best adapted to these selection pressures have an increased chance of surviving and reproducing. Less well adapted organisms die or fail to reproduce. This process is known as ‘survival of the fittest’.</p> <p>Genes from the successful organisms are passed onto their offspring in the next generation. This means the offspring are likely to possess the characteristics that made their parents successful. This process is repeated. Over time, the number of individuals with the advantageous adaptation increases. Therefore the frequency of the allele which codes for this particular characteristic increases in the population.</p> <p><i>Evolution:</i> This takes place when natural selection takes place in two different populations, separated by geography, niche etc. The selection takes the populations in different directions until eventually they cannot interbreed successfully and new species have been formed. The formation of new species by natural selection is evolution.</p>		
2 (c)	The parasite has a number of different hosts. The more hosts it can attack the more likely it is to survive. It will need different proteins to survive in the different hosts. A large genome means it can code for a wide range of different proteins at different stages in its life cycle, and is therefore a useful adaptation to the parasitic way of life.		
(d)	<p><i>Spirometra erinaceieuropaei</i> DNA sequencing allows comparison with other species and similar specimens for identification, enables identification of pathogen. Allows identification of vulnerabilities to drugs</p> <p>Wider points – any sensible suggestions e.g., classification – allows identification of new species, identification of evolutionary links by similarities and differences in DNA sequences, intra-specific differences and genetic diversity</p>		

	can be measured Medicine – real time identification of pathogens in outbreak, monitoring spread of an outbreak, development of vaccines and medicines, identification of strains resistant to medicine etc.		
Extension 1	Clear description given of the expected specific immune response – a flow chart or diagram is a useful way to do this.		
2	Evidence of research into the ways in which parasites avoid rejection/destruction by their host organism. For example, gross anatomy – hooks, suckers etc which allow the parasite to position itself in the host. Some are physiological, for example, reproductive strategies (used by <i>Spirometra erinaceieuropaei</i>). Many are biochemical – this is the way <i>Spirometra erinaceieuropaei</i> and other tapeworms suppress the host immune system to prevent it recognising and attacking them, for example, by producing oxylipins (oxygenated forms of fatty acids) and eicosanoids such as prostaglandins which interact with the host immune system and, for example, suppress phagocytosis and cytokine actions, block enzyme action in host cells, and interfere with the immune system cascades.		
3	One or two page report on chosen biochemical response, with clear explanations and including diagrams if they are helpful. Evidence of research from multiple sources (including scientific papers).		