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Answer ALL questions in the spaces provided

1. The temperature of the human body is kept within narrow limits by negative feedback mechanisms.

(a) Following a rise in core temperature, describe the sequence of events in the body that returns the temperature to normal.

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(b) Describe how this response might be different in a person infected with tuberculosis.

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(c) Explain how a forensic scientist's estimate of time of death could be affected if the victim had tuberculosis.

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(Total 7 marks)

Q1



2. (a) Explain how mutation differs from crossing over in the way that genetic variation is generated.

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(b) The photograph below shows a picture of a sweet pea plant with its tendrils wrapped around the supports.



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The diagram below shows two pairs of chromosomes from a sweet pea plant. The positions of the alleles of three genes are shown.



The table below shows alleles of the three genes.

Gene	Dominant allele	Recessive allele
Flower colour	Purple (R)	Red (r)
Pollen shape	Long (L)	Round (l)
Tendrils	Present (T)	Absent (t)



- (i) The table below lists the genotype of six gametes produced by this plant. Place a tick (✓) in the box next to each gamete that must have been the result of crossing over.

Genotype	Tick
RLT	
rIT	
RIT	
RLt	
Rlt	
rLt	

(2)

- (ii) A sweet pea plant with purple flowers and tendrils was crossed with another with red flowers and no tendrils. Both plants were homozygous for these two genes.

Use a genetic diagram to show the genotypes and phenotypes expected in the F₂ generation when the offspring of this cross were bred together.

(5)



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(c) A polar bear born in Berlin Zoo was rejected by its mother and had to be reared by humans. A group of people concerned with animal welfare wanted the bear to be destroyed, since they claimed that the animal could never be released into the wild.



Suggest reasons that the zoo might have had for keeping the bear when it became an adult.

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Q2

(Total 12 marks)



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N 2 9 2 2 3 A 0 7 2 0

3. An investigation was carried out to find the distribution of plant species on sand dunes. A transect was used which extended inland from a beach. Quadrats were used at nine positions along the transect. The percentage cover of selected species was recorded in each quadrat as well as the number of plant species in each quadrat. A sample of soil was taken from the area within each quadrat and used to measure the mass of organic material present.



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The results are shown in the two tables below.

Quadrat number	1	2	3	4	5	6	7	8	9
Distance from top of beach / metres	0	80	170	250	500	650	980	1600	1980
Number of species found	1	1	5	11	18	7	5	2	2
Mass of organic material / grams	0.4	0.3	0.3	0.9	2.8	6.4	25.1	23.4	32.8

Quadrat number	Percentage cover								
	1	2	3	4	5	6	7	8	9
Bare sand	80	30	30	8					
Sea couch	20								
Marram grass		70	50	20	5	5			
Red Fescue			5	40	55	40			
Sea buckthorn							80		
Common heather								90	
Corsica pine									100



(a) Explain why it is necessary to use a quadrat to estimate percentage cover.

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(b) Explain why a transect is more appropriate than random sampling in this study.

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(c) Use the information in both tables to compare the data collected from quadrat 1 and quadrat 5.

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N 2 9 2 2 3 A 0 1 1 2 0

4. One of the reactions of photosynthesis can be summarised as shown below.



(a) Name the reaction shown.

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(b) Give **one** other factor, not shown above, that would be required for this reaction to occur in a chloroplast.

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(c) Describe the role of the electrons in the light dependent reaction of photosynthesis.

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(d) Describe and explain how the products of the light dependent reaction are involved in the production of glyceraldehyde-3-phosphate (GALP).

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(e) GALP does not accumulate in a chloroplast during photosynthesis. Explain how GALP is used following its production.

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(Total 12 marks)

Q4

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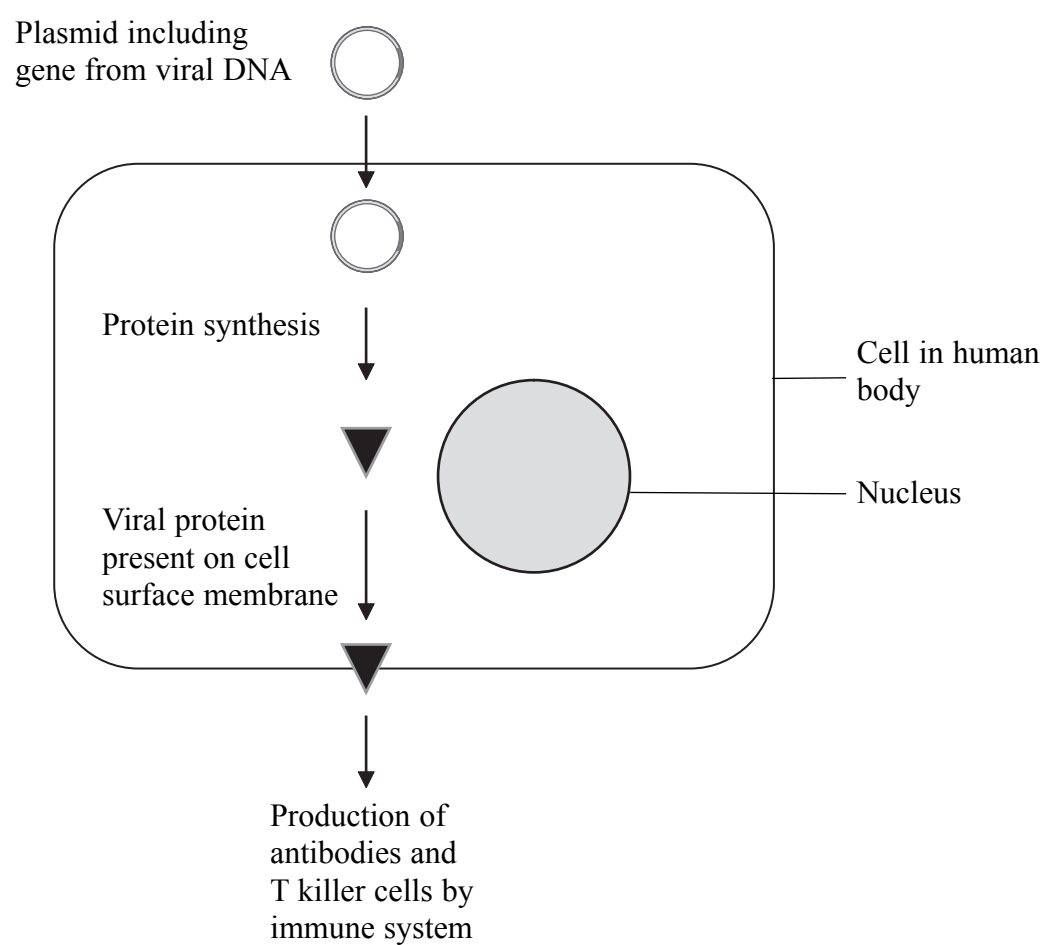
N 2 9 2 2 3 A 0 1 3 2 0

5. A new technique for vaccinating people involves injecting them with DNA.

Viruses have proteins on their coats that are coded for by their DNA. The genes for producing viral proteins can be isolated and inserted into loops of DNA (plasmids). Plasmids can enter human cells which will then produce the viral proteins. The proteins will become part of the surface membrane of the human cell.

The immune system will recognise these proteins as foreign and respond by producing antibodies and T killer cells.

The process is summarised for one protein in the following diagram.



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(a) Explain why the response of the immune system to the viral proteins is an example of active immunity.

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(b) Explain how active immunity provides immunity against future infections by the virus.

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(c) The table below compares the production and distribution of vaccines made using traditional methods with those made using DNA.

	DNA vaccine	Traditional vaccine
Time to develop vaccine against new strain of virus	2–3 weeks	4–6 months
Time to produce enough doses for effective protection of population	2–3 months	2–3 years
Treatment during distribution	No special treatment	Constant refrigeration

Use the information in the table to suggest why the DNA vaccine is likely to be more effective at preventing the spread of a new strain of virus.

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(d) A traditional vaccine involves the injection of viral protein into the body. This usually stimulates the production of antibodies but not T killer cells. Suggest how the use of viral DNA might be more effective than viral protein in producing immunity to a virus.

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Q5

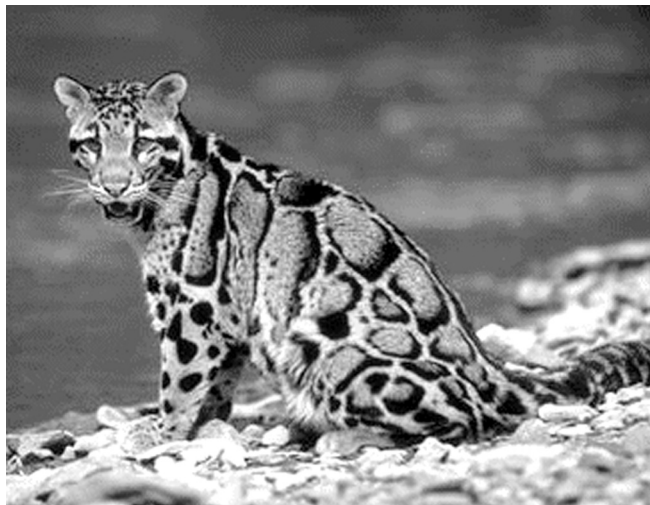
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6. A new species of large cat, the clouded leopard (*Neofelis diardi*) has been identified on the island of Borneo. *Neofelis diardi* on Borneo is distinct from *Neofelis nebulosa* on the mainland.



- (a) Explain why the clouded leopard and the mainland leopard share the name *Neofelis*.

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(1)

- (b) There are 46 genetic differences between the two species of leopard. Explain how these differences may have arisen, assuming that the two species share a common ancestor.

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(c) The clouded leopards are found in regions of the island of Borneo that are governed by three different countries, Brunei, Indonesia and Malaysia.



The Island of Borneo

Suggest reasons why this may make the conservation of leopard habitats difficult.

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Q6

(Total 6 marks)

TOTAL FOR PAPER: 60 MARKS

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