Biology

Final exam
Examination 2017

Marking Key

Section One: Multiple Choice **30% (30 marks)**

1	[A]	[B]	[C]	[D]	16	[A]	[B]	[C]	[D]
2	[A]	[B]	[C]	[D]	17	[A]	[B]	[C]	[D]
3	[A]	[B]	[C]	[D]	18	[A]	[B]	[C]	[D]
4	[A]	[B]	[C]	[D]	19	[A]	[B]	[C]	[D]
5	[A]	[B]	[C]	[D]	20	[A]	[B]	[C]	[D]
6	[A]	[B]	[C]	[D]	21	[A]	[B]	[C]	[D]
7	[A]	[B]	[C]	[D]	22	[A]	[B]	[C]	[D]
8	[A]	[B]	[C]	[D]	23	[A]	[B]	[C]	[D]
9	[A]	[B]	[C]	[D]	24	[A]	[B]	[C]	[D]
10	[A]	[B]	[C]	[D]	25	[A]	[B]	[C]	[D]
11	[A]	[B]	[C]	[D]	26	[A]	[B]	[C]	[D]
12	[A]	[B]	[C]	[D]	27	[A]	[B]	[C]	[D]
13	[A]	[B]	[C]	[D]	28	[A]	[B]	[C]	[D]
14	[A]	[B]	[C]	[D]	29	[A]	[B]	[C]	[D]
15	[A]	[B]	[C]	[D]	30	[A]	[B]	[C]	[D]

Section Two: Short Answer 50% (100 marks)

Question 31 **(20 marks)**

Cholera is a communicable disease that was first noticed amongst Portuguese sailors in the 16th century. The first major pandemic was recorded in 1871. The last pandemic began in 1961 and lasted 14 years. Despite modern medical treatment, Cholera still presents a significant problem in many third world countries today.

Cholera is an acute intestinal infection that causes nausea, vomiting and copious, watery diarrhoea. These symptoms can lead to severe dehydration and, if left untreated, death. Most deaths result from shock, which is caused by a severely reduced blood volume. Cholera has a short incubation period of between 1 and 5 days. Fatalities may be as high as 50% in communities without access to appropriate treatment.

The pathogen that causes Cholera is found in aquatic environments and harbouring within humans themselves. However, Cholera is rarely transmitted through person-to-person contact.

(a) Suggest the most likely modes of transmission for Cholera. (2 marks)

Description	Marks
Dirty water (drinking) / waterborne transmission / indirect contact.	1
Contamination of food with infected body fluids / faecal-oral route.	1
TOTAL	**2**

(b) Suggest how environmental factors could influence an outbreak of Cholera. (2 marks)

Description	Marks
Two points from the following or other suitable answers;	
Serious flooding causes overflow from treatment plants or sewage.	1
Climate change causing more extreme weather events/changes in local aquatic ecology.	1
Natural disasters affecting clean water supplies.	1
Contamination of available water by faeces/effluent.	1
High temperatures combined with low water levels.	1
Heavy rainfall.	1
TOTAL	**2**

(c) Describe **three (3)** preventative measures that would be most effective against the spread of Cholera. (3 marks)

Description: Three points from the following;	Marks
Provision of bottled drinking water.	1
Treatment of drinking water with chemicals or boiling it	1
Washing hands after toilet and before food preparation.	1
Keep ablutions away from drinking water.	1
Keep farm animals away from drinking water.	1
Quarantine if caught early	1
TOTAL	**3**

(d) Define the term 'pandemic'. (2 marks)

Description	Marks
Outbreak of a particular infectious disease (1) throughout the world (1)	1 – 2
TOTAL	**2**

(e) Explain why is it still possible for a Cholera pandemic to occur in the future. (3 marks)

Description: any three	Marks
Travel from infected to non-infected areas.	1
Extreme weather events from climate change becoming more frequent.	1
Continuing lack of treatment in susceptible areas.	1
lack of infrastructure for good hygiene eg flushing toilets	1
TOTAL	**3**

Antibiotics are often used as a form of treatment for Cholera infections. However, resistance to some types of antibiotics is increasing in many regions susceptible to outbreak.

(f) State the type of pathogen causes Cholera. Explain your choice. (3 marks)

Description	Marks
Bacteria.	1
Antibiotics only work on bacteria and not other pathogens like viruses.	1
Bacteria can live and reproduce outside body, eg., in waterbodies.	1
TOTAL	**3**

(g) Explain how pathogens like this can become resistant to antibiotic treatment. (3 marks)

Description	Marks
Antibiotics are overprescribed for prevention and not treatment.	1
Natural selection 'chooses' phenotypes in bacteria that resist antibiotics.	1
Bacteria reproduce and mutate very rapidly allowing for new strains to evolve.	1
TOTAL	**3**

(h) Vaccines are available that provide short-term protection. These are mostly used for travellers visiting affected regions.

Describe why would health authorities **not** recommend the use of vaccines to prevent Cholera outbreaks? (2 marks)

Description	Marks
Two points from the following;	
Only short-lived protection.	1
People will forget to use other preventative measures.	1
Costly and time-consuming/logistically difficult for short-term benefits.	1
Current cholera vaccines provide incomplete protection.	1
TOTAL	**2**

Question 32 **(20 marks)**

The Pygmy Sloth (*Bradypus pygmaeus*) is one of four, three-toed sloth species from the genus *Bradypus*. It was first identified as a separate species in 2001. The Pygmy Sloth is endemic to the small island *Isla Escudo de Veraguas* which is situated off the north coast of Panama in the archipelago of Bocas del Tora. The remaining species of *Bradypus* can be found on other islands within this archipelago and on the mainland.

The Pygmy Sloth has attracted much attention due to the rapid evolution of its small body size, which is significantly smaller than the other *Bradypus* species and 40% smaller than its other mainland relatives. The Pygmy Sloth has a total body length of approximately 53cm and weighs up to 3.5kg. Its diet is restricted to the leaves of the Red Mangrove, in which it lives. These trees grow around the perimeter of the island. Unlike other mammals, the sloth is not strictly homeothermic and must therefore live in warm, tropical climes. The fur of the Pygmy Sloth is tinted green due to algal symbionts residing in each hair strand. According to the IUCN, the Pygmy Sloth is critically endangered due to habitat degradation and illegal hunting.

Research on the *Bradypus* genus has suggested that the rapid evolution of the small body size (dwarfism) can be attributed to the geology and geography of the islands within the archipelago; age of the islands (time of isolation from mainland), area of the islands and distance from the mainland.

Consider the information provided in the table below regarding geological characteristics of the islands and the average skull size of their sloth inhabitants.

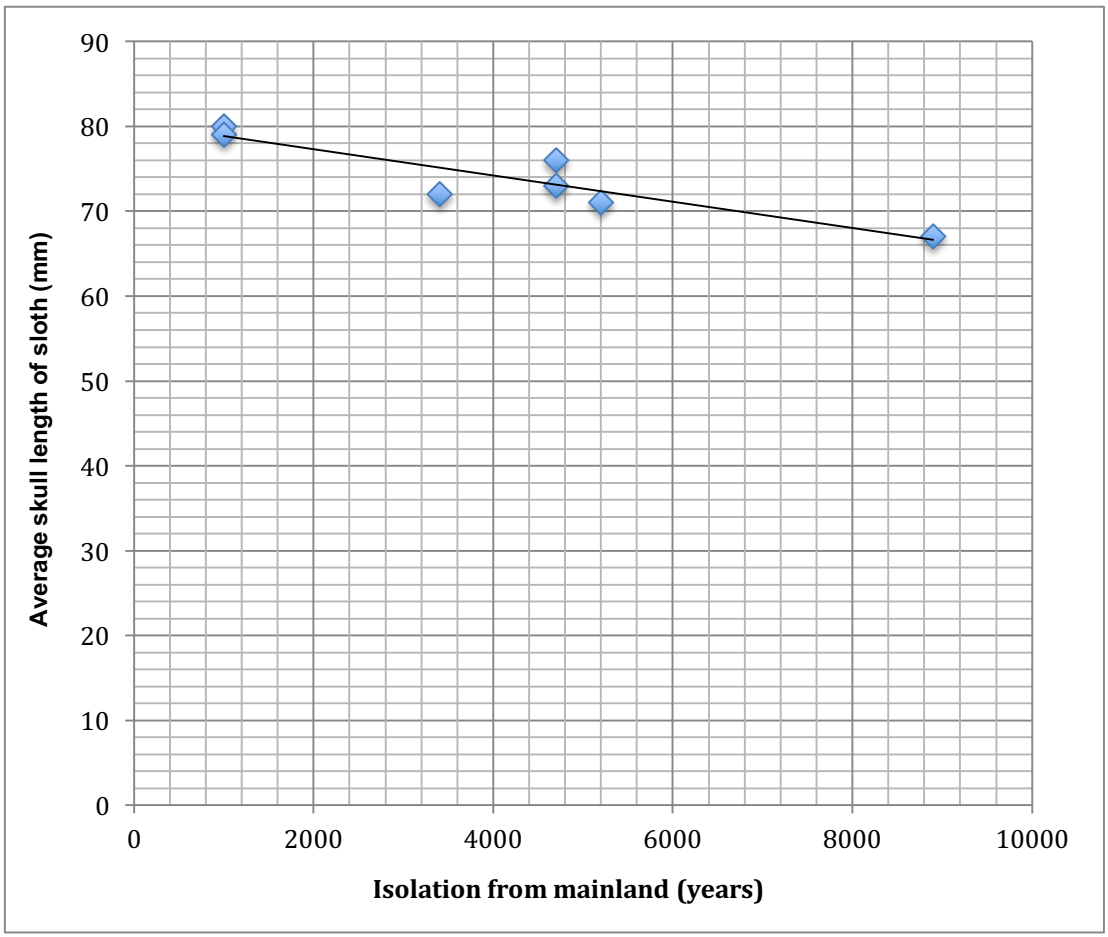
Table 1 – Average skull length (mm) of species from the *Bradypus* genus from islands of the Bocas del Tora archipelago, Panama.

Island Name	Time of isolation from mainland (years ago)	Distance from mainland (km)	Area of island (km^2)	Average skull length of sloth (mm)
Isla Escudo de Veraguas	8900	17.6	4.3	67
Isla Colon	5200	1.5	59.0	71
Isla Bastimentos	4700	6.3	51.5	73
Cayo Nancy	4700	9.5	6.8	76
Cayo Agua	3400	6.6	14.5	72
Isla Popa	1000	1.8	53.0	80
Isla Cristobal	1000	0.3	36.8	79

(Adapted from Anderson & Handley, 2002)

(a) In the space provided below, construct an appropriate graph using the data regarding average skull length (mm) and time of isolation of islands from the mainland. (6 marks)

Title – Average skull length for *Bradypus* sloth species from different aged islands of the Bocas del Tora archipelago, Panama.



Description	Marks
Title	1
Axes scale	1
Axes labels with units	1
Correct X and Y axes position	1
Scatter plots correct	1
Line of best fit or connected points	1
Untidy (messy)	(-1)
TOTAL	**6**

(b) Describe the relationship between the variables shown in the graph. (2 marks)

Description	Marks
Negative/ inverse correlation	1
Older the island, smaller the skull.	1
TOTAL	**2**

(c) Describe **two (2)** reasons why the other geographical factors shown in the table do not appear to have influenced the evolution of small size in the *Bradypus* sloths. (4 marks)

Description	Marks
Size of island not important. Pygmy sloths only inhabit coastal mangroves so have a small niche. Territorial and don't move far from their 'home' for whole life.	1 1
Distance less important than age. Once isolation occurs, no mixing of gene pools because they don't change between islands.	1 1
TOTAL	**4**

Island ecology is often of great interest to many scientists as many island ecosystems are characterised by species with interesting and exaggerated traits. Research has suggested that genetic drift and mutation can be ruled out as mechanisms for the rapid evolution of small body size in the Pygmy Sloth (*B. pygmaeus*).

(d) Outline the mechanisms that have driven Pygmy Sloth evolution on Isla Escudo de Veraguas. (4 marks)

Description	Marks
Divergent evolution / adaptive radiation	1
Gene flow disrupted due to geographical isolation.	1
Allopatric speciation occurs.	1
Directional speciation because a phenotype is favoured (natural selectio and causes a shift in gene pool in one direction.	1
TOTAL	**4**

(e) Describe **two (2)** ways in which the Pygmy Sloth's adaptations have assisted its survival despite negative human impact on its environment. (4 marks)

Description	Marks
Two points from the following:	
Less energy needed for thermoregulation (1) so less food required (1)	1 - 2
Small size / high surface area to volume / more heat gained (1) so less energy required (1)	1 - 2
Camouflage from algae in hair (1) to avoid predators and/or to prevent illegal hunters attacking (1)	1 - 2
TOTAL	**4**

Question 33 **(20 marks)**

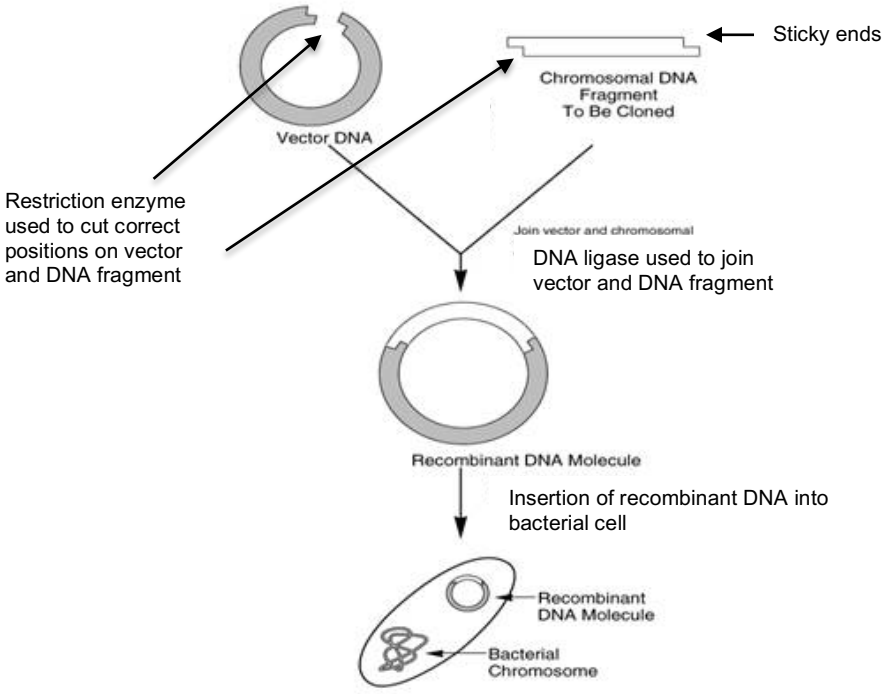
Gene cloning allows the replication of whole gene sequences and the subsequent production of its associated protein. Bacteria have an important role to play in gene cloning as they can reproduce quickly and easily in the laboratory and contain plasmids.

(a) Define the term 'bacterial plasmid'. (2 marks)

Description	Marks
Small, circular DNA molecule separate from chromosomal DNA.	1
Can replicate independently of rest of bacterial cell.	1
TOTAL	**2**

(b) In the space below, construct a labelled diagram that shows the sequence of events for the technique that results in the formation of recombinant DNA in a bacterial cell. (6 marks)

Eg.,



Description	Marks
Diagram must include; Plasmid vector and gene to be cloned/inserted Recombinant DNA plasmid molecule New bacterial cell with separate chromosome and recombinant DNA plasmid.	 1 1 1
Labelling must include/mention; Correct enzymes for cutting and joining DNA - ligase and restriction. Sticky ends on plasmid and gene to allow for annealing. Insertion of recombinant DNA plasmid into bacterial cell for cloning.	 1 1 1
TOTAL	**6**

The use of recombinant bacteria has been influential in the development of genetically modified crop species.

(c) Outline **three (3)** major developments in agriculture as a result of recombinant DNA technology. (6 marks)

*Students must include **three (3)** points from the following. One mark is allocated for development and one mark for explanation.*

Description	Marks
Herbicide resistance – insertion of gene that causes crop species to be unaffected by chemical herbicides such as Round-up®. Farmers can spray their crops for weeds without killing crop plants.	1 1
Insect resistance – reduce time and money spent by farmers spraying crops with insecticides - eg BT Cotton No residual chemicals on food bought by consumers.	1 1
Drought tolerant plants – require less water and/or irrigation. Beneficial for farmers in areas that are becoming increasingly dry due to climate change.	1 1
Increased concentration of vitamins in food – gene that codes for the desired nutrient is spliced into the organisms DNA. This plant or animal will produce more of this nutrient and therefore the food source is enriched - eg 'Golden Rice'	1 1
Frost resistance – 'antifreeze' gene is spliced into crops that are grown in climates where frost damage could occur. Saves whole crops from damage and farmers losing income.	1 1
TOTAL	**6**

(d) Describe **two (2)** possible negative effects on the environment as a result of the production of genetically modified crops. (4 marks)

Description	Marks
• Seeds from modified species spread to other properties or bushland. • GM plants could then infest neighbouring paddocks that do not grow GM plants or are organic producers/Lose organic status.	1 - 2
• Overuse of herbicides on resistant crops (eg., Round-up® Ready). • May affect plants on adjacent properties that are not GM or in natural environment • May stimulate evolution of 'superweeds' • Could pollute soil and water sources.	1 - 2
TOTAL	**4**

(e) Explain how biotechnology has helped improve the conservation of endangered species bred in captivity. (2 marks)

Description	Marks
• Can determine the genetic variability of a species to avoid inbreeding. • Help increase diversity of the gene pool.	1 – 2
TOTAL	**2**

Question 34 **(20 marks)**

The chemical reactions of metabolic pathways produce wastes that must be excreted. These include carbon dioxide, nitrogenous wastes and water.

(a) Explain why the removal of metabolic wastes from an organism is essential for continued metabolic activity. (3 marks)

Description	Marks
Toxic to cells	1
Change pH of blood and fluids, enzymes may denature.	1
Metabolic reactions slow down in response.	1
TOTAL	**3**

(b) Using the information in **Table 2**, explain the differences in nitrogenous waste production and excretion, in relation to the environment, for each animal group. (6 marks)

Description	Marks
Animals like fish excrete nitrogenous wastes as ammonia as they have access to lots of water. Ammonia is very soluble but can be tolerated only at very low concentrations.	1 1
Ammonia excretion is much less suitable for land animals like mammals and reptiles because; • Ammonia it is highly toxic. • They do not have access to a large water supply to dilute the ammonia.	 1 1
Urea and uric acid is excreted by land animals; • Much less toxic than ammonia. • Requires very little water to excrete.	 1 1
TOTAL	**6**

The structure and physiology of the kidney of mammals from arid environments is highly adapted to reduce water loss.

(c) Describe the structure of the kidney from a desert marsupial and explain how this structure enables the marsupial to produce concentrated urine. (4 marks)

Description	Marks
Long loop of Henle.	1
Salt gradient more extreme due to longer loop	1
More water reabsorbed by osmosis due to high salt concentration in extracellular fluid.	1
Water reabsorbed from collecting duct/ enters tissue capillaries	1
TOTAL	**4**

A group of biology students were asked to design an experiment regarding the effect of increased levels of ammonia in aquaculture hatcheries. Their aim was to:

'*Find out the effect of increased ammonia concentration in the water on the hatching success rate for a commercially produced aquaculture fish species*.'

(d) Propose a possible hypothesis for this investigation. (2 marks)

Description	Marks
Independent variable in hypothesis	1
Dependent variable in hypothesis	1
TOTAL	**2**

Eg., Hatching success rate will decrease with increasing ammonia concentration.

(e) Identify the variables that should be considered to test this hypothesis.

(i) Independent variable (1 mark)

Description	Marks
Concentration of ammonia in water	1
TOTAL	**1**

(ii) Dependent variable (1 mark)

Description	Marks
Hatching success rate (%)	1
TOTAL	**1**

Aquaculture is practiced worldwide. Collecting viable data from investigations such as this can be difficult due to large variations in water quality within and between aquaculture facilities.

(f) Identify **three (3)** variables that must be controlled in this investigation to ensure viable data is collected. (3 marks)

Description	Marks
Three variables from the following;	
Water temperature	1
Dissolved oxygen	1
Water pH	1
Pesticide content	1
Salinity	1
Nutrient content (eg., Phosphorus and Nitrogen)	1
fish diet	1
TOTAL	**3**

Question 35 **(20 marks)**

(a) Identify **three (3)** main reasons for constructing a phylogenetic tree in studies of evolutionary biology. (3 marks)

Description	Marks
Shows inferred evolutionary relationships between organisms.	1
Illustrate historical evolution (in a structured manner) and relative time frame since last shared common ancestor.	1
Depicts the lines of evolutionary descent of different species, organisms, or genes from a common ancestor.	1
TOTAL	**3**

(b) Describe the difference between distantly related and closely related organisms in terms of their:

(i) DNA sequence. (3 marks)

Description	Marks
Closely related organisms share more DNA base pair matches than those distantly related.	1
DNA sequences encode the proteins responsible for functions that were; • conserved from the last common ancestor, should be • preserved in contemporary genome sequences.	 1 1
TOTAL	**3**

(ii) Position on a phylogenetic tree. (2 marks)

Description	Marks
The more closely related organisms have branches that are closely positioned and have a more recent shared common ancestor.	1
Distantly related organisms are on separate branches that have separated much earlier in evolutionary history and more time has passed since sharing a common ancestor.	1
TOTAL	**2**

(c) Describe **two (2)** other methods, using species' anatomy, that are used by evolutionary biologists to provide evidence for evolution. (4 marks)

*Student must include any **two (2)** different methods from the following;*

Description	Marks
Comparative Embryology – common features of organisms different in adults appear in embryonic development. Provides evidence for common ancestry between different animal groups.	1 1
Homologous Features – features of different organisms with a fundamental similarity in structure. (hands/wings/fins). Evolution from a common ancestor and divergent evolution can be inferred.	1 1
Analogous Features – similar structure with the same function but evolved independently. Evidence of convergent or parallel evolution.	1 1
Vestigial Structures – structures with no apparent function resembling structures found in other organisms. Comparative vestigial structures provide evidence for evolutionary relationships and common ancestry.	1 1
TOTAL	**4**

Since the beginning of life on Earth some 3.5 billion years ago, species evolution has coincided with environmental change. For organisms to survive significant changes in their environment, the process of sexual reproduction must provide for genetic variation.

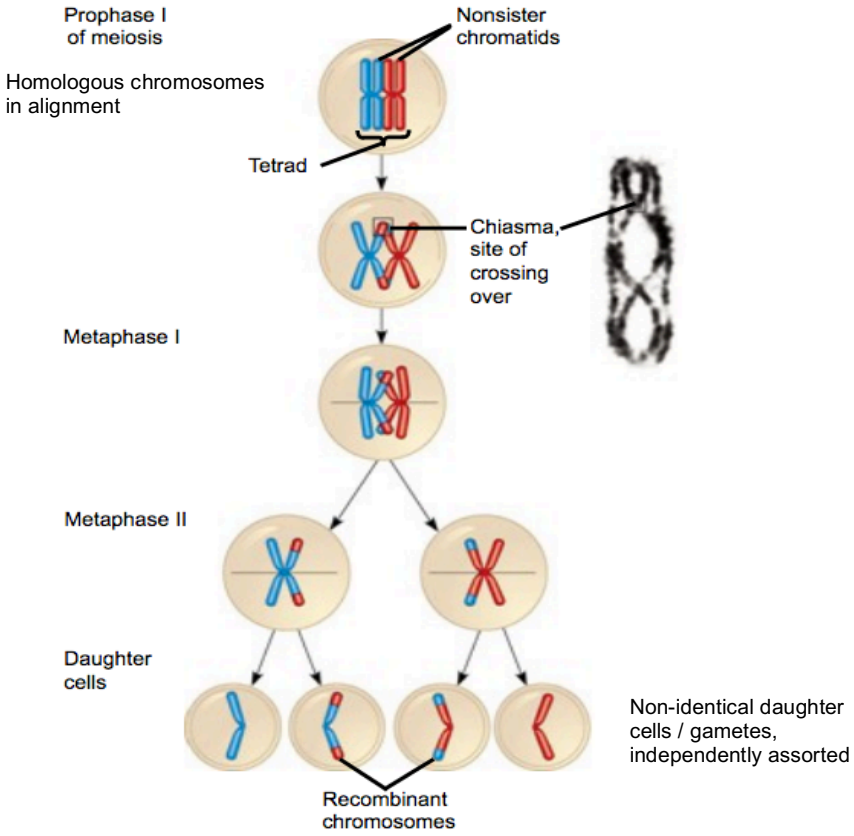
(d) Identify **two (2)** different ways that genetic variation can be increased as a result of sexual reproduction. (3 marks)

*Students must include **two (2)** from the following points.*

Description	Marks
Crossing over (meiosis) of genes/DNA.	1
Independent assortment (meiosis) of alleles.	1
Fertilisation with random gametes.	1
TOTAL	**2**

(e) In the space below, draw a simple, labelled diagram to *explain* how genetic variation arises during **meiosis** through changes to chromosomes. (6 marks)

Eg.,



Description	Marks
Diagram must show; • homologous chromosomes • crossing over of homologous chromosomes. • 4 daughter cells/gametes with ½ genetic information and recombinant chromosomes.	 1 1 1
Labelling must include/mention; • Homologous chromosomes/non-sister chromatids aligning in Meiosis I • Site of crossing over - chiasmata – and exchange of genes. • Independent assortment of recombinant chromosomes into four daughter cells/gametes so none are identical.	 1 1 1
TOTAL	**6**

Section Three: Extended Answer 20% (40 marks)

These marking guides may not contain some details taught in different schools or classrooms. Please add, adjust or alter points within each guide as necessary to meet the specific needs of your students.

Unit 3

Question 36 (20 marks)

(a) Compare the processes of DNA replication and transcription in eukaryotic cells. (10 marks)

Points for comparison must occur in pairs, as shown in the table below. Five 'pairs' need to be included for full marks.

Description	Marks
DNA replication copies both strands of DNA from an entire chromosome to make a new double helix strand of DNA. Transcription copies the template strand of a section of DNA / gene to form an mRNA molecule.	1 1
DNA replication happens only during the cell cycle / synthesis / mitosis when new cells are being formed. Transcription occurs when the cell requires production of a protein or enzyme.	1 1
All DNA in the nucleus is copied in replication. Transcription only copies a small section – gene – of DNA on one chromosome.	1 1
Both processes require DNA helicase to break the hydrogen bonds and unzip the DNA molecule. DNA ligase not required in transcription.	1 1
DNA replication undergoes 'proof reading' by a DNA polymerase. This does not occur in transcription and errors can result in non-functional proteins / enzymes.	1 1
Both processes involved complementary base pairing. In mRNA Thymine (T) is replaced with Uracil (U). A bonds with U.	1 1
Both processes copy in 5' to 3' direction. No Ozaki fragments in transcription.	1 1
DNA replication has many starting points along the chromosome. Transcription has one start and one stop point.	1 1
DNA molecule is a deoxyribose double strand. RNA molecule is a ribose single strand.	1 1
Products of replication stay in nucleus. mRNA from transcription leaves nucleus for the ER and ribosomes for translation.	1 1
Transcription uses RNA polymerase Replication uses DNA and RNA polymerase	1 1
TOTAL	**10**

(b) Describe the technique used to visualise a nucleotide sequence from a molecule of DNA. Explain how this technique could enable a researcher to determine the relatedness between family members

Description	Marks
Gel electrophoresis is the technique used to visualise DNA. This involves separating the DNA strand to be analysed into fragments based on their size (number of base pairs).	1
DNA is prepared/cut by restriction enzymes/amplified by PCR.	1
DNA fragments loaded onto gel/placed in a well/holes in a gel.	1
Electric current is passed through gel.	1
DNA fragments are negatively charged so move to positive electrode.	1
A “control” well (containing fragments of known size) is assigned to allow comparison with the samples.	1
Larger fragments (more base pairs) travel more slowly/smaller fragments travel faster	1
The samples separate along the length of the gel matrix creating the characteristic banded pattern (that scientists compare with other patterns the gel onto determine similarity or difference).	1
The more similar the banding the more closely related the samples.	1
Paternity testing can use this method to identify whether a child belongs to the father. Samples of same sequence of DNA are tested. Matching fragment positions and size can identify relatedness. More matches = more closely related.	1
TOTAL	**10**

Question 37 (20 marks)

(a) Describe the type of data that can be obtained directly from fossils. Explain how palaeontologists infer information from fossils to 'fill the gaps' in the fossil record to provide evidence of evolution. (10 marks)

Description	Marks
Description of fossil data (up to 6 marks):	
Many types fossils / whole organisms, bones, teeth, plant leaves, pollen etc…/ make up the fossil record.	1
Fossils are traces of past life/provide information about the history of life	1
Preserved structures are used to calculate relative age and size of organism.	1
Aging can be done directly from the fossil or by dating the rock in which it was found.	1
Radioactive dating provides accurate method of confirming age of rocks and fossils.	1
Soft tissue does not fossilise well. Inference used to identify appearance of tissue over skeletons.	1
Based on the size and structure of organism, diet and habitat can be inferred.	1
Other information present in the rocks can be used to help identify habitat, prey, predators and vegetation.	1
Explanation of inferences to fill gaps (up to 4 marks):	
Gaps in the fossil record can be present due to; • Inappropriate conditions for fossilisation, OR • Undiscovered fossils, OR • Fossils may have been destroyed or inaccessible.	1
Fossils can be compared with other fossils. Similarities and differences in anatomy have enabled palaeontologists make evolutionary links between organisms and to a common ancestor.	1
Fossils show that organisms from the past are not the same as those in the present	1
Fossils show that the total number of species that have existed is much greater than what is present today	1
Fossils show the evolution/transition/progression/change of one type of organism to another.	1
TOTAL	**10**

(b) Describe the comparative studies of DNA and mitochondrial DNA and explain how they can offer evidence for evolution. (10 marks)

Description	Marks
Process of comparative studies (up to 8 marks):	
Molecular or DNA hybridisation – when single, complementary strands of DNA or mitochondrial DNA from different species are brought together.	1 1
Code/sequence in DNA is different for different species	1
Exact % difference between organisms can be identified based on the sequence of nucleotides.	1
Chromosomes or specific DNA sequences are isolated from species' genomes.	1
The DNA double helix molecules for the chosen DNA sequences (from the species to be compared) are heated to the temperature at which the DNA unwinds. Hydrogen bonds dissociate or denature.	1
Single strands of the DNA sequences to be compared are mixed together and cooled.	1
On cooling, the single strands "renature"/ the complementary base pairs for each species are brought together and bond to each other.	1
The more similar the sequences the more easily they will hybridise. The more base pairs are bonded.	1 1
Level of hybridisation is tested by reheating the new hybrid DNA molecules to the temperature of the original DNA.	1
The more stable the heated molecule (thermostability) then the more similar the DNA sequences of the species being compared.	1
mtDNA inherited from mother only	1
Higher rate of mutation than nuclear DNA	1
Evidence for evolution (up to 2 marks):	
Species that are distantly related have more differences in their DNA / closely related more similarities / more time has passed since common ancestry	1
The number of genes shared by the organisms being compared can provide evidence that they once shared a common ancestor.	1
Estimate closeness of relationship through maternal ancestry/useful for same species or closely related species / more time has passed since common ancestry.	1
TOTAL	**10**

Unit 4

Question 38 **(20 marks)**

(a) Describe the behavioural adaptations of desert marsupials and explain how these adaptations support thermoregulation. Use examples to support your answer. (10 marks)

Description	Marks
Nocturnal – examples include; Bilby, Chuditch, hopping mice, bandicoots, kangaroos.	1
Most marsupials forage or hunt at night when it is cool. This helps retain water for metabolic activities and conserve energy.	1
Burrowing – examples include; wombats, burrowing bettongs, bandicoots.	1
Formation of long, deep burrows protects animals from heat of the day. Cool burrows enable safe sleeping during which metabolism is slower, thereby saving energy and water.	1
Sleeping during heat of day – kangaroos, most other nocturnal marsupials.	1
Less heat production via metabolism during activity. Less need for thermoregulatory mechanisms to expel heat.	1
Shade – kangaroos, burrowing marsupials, wallabies.	1
Reduces absorption of heat from sun and ground via radiation and conduction. Saves energy from slower metabolism.	1
Coating forearms with saliva – kangaroos.	1
Kangaroos lick thin forearms and cover with saliva. Breeze evaporates and cools skin and blood in vessels close to skin.	1
TOTAL	**10**

(b) Identify and explain the adaptations of Australian xerophytes living in arid environments. (10 marks)

*Students must identify and explain at least **five (5)** different adaptations from the following;*

Description	Marks
Shallow, extensive root systems. Maximises the uptake of water from the soil when it is available. Eg., after rain.	1 1
Sunken stomata. Stomata/guard cells are located in deep depressions on the leaf. Maintains humid conditions around stomata to reduce rate of transpiration.	1 1
Thick cuticle on leaves. Reduces uncontrolled evaporation of water from the leaf cells.	1 1
Succulent leaves or stems. Storage of water in leaves and stems to prevent drying out during long periods without access to water.	1 1
Reduced number of stomata. Fewer 'holes' in the leaves for water to escape through transpiration.	1 1
Stomata on underside of leaves. More humid air on the underside of leaves so less evaporation.	1 1
Stomata close during heat of the day. Stops transpiration to prevent water loss from stomata (and keep plant turgid).	1 1
Curled leaves. Maintains humid conditions around stomata. Reduces rate of transpiration and therefore loss of water from stomata.	1 1
Leaf hairs. Usually found on top surface of leaf. Create a humid layer to reduce rate of transpiration.	1 1
Waxy leaf or stem surface. Physical barrier coating leaves that prevents water loss from leaf cells.	1 1
Small leaves/small surface area. Less area for evaporation from leaf surface.	1 1
TOTAL	**10**

Question 39 (20 marks)

(a) Describe the main factors that influence the transmission of disease-causing pathogens within and between populations. (10 marks)

Description	Marks
Factors that influence the transmission of disease are interrelated and include Pathogen factors, Environmental factors and Host factors.	
Environmental factors include sanitation infrastructure, climate and ecology influence transmission of disease.	1
Inefficient sewerage systems and access to safe drinking water.	1
Climate change reflected in temperature increases causes change in ecosystems and provide new conditions for pathogen growth and spread.	1
Hosts (people) can affect the transmission of disease through behaviours, susceptibility to infection and population density.	1
Diseases that are transmitted through body fluids/blood can be spread more readily by people who engage in risky behaviours, such as unprotected sex and unsafe drug use.	1
Immune supressed, elderly and very young people are more susceptible to infection and less able to fight infection.	1
If population density is huge, and people live in close proximity, then transmission rates increase, as there is more opportunity for pathogens to be spread between individuals.	1
Pathogens themselves can strongly impact the transmission of disease through the mechanism with which they spread. Diseases that are transmitted through a **vector**, such as mosquitoes, can reach many more people than one that is directly transmitted.	1
The pathogen's **infectivity** also affects transmission. The easier it is to spread from one host to another, the more infectious a pathogen. Eg., Influenza.	1
The pathogen's lifecycle can influence transmission. Diseases that have a long latency and show no symptoms are still contagious. People infected with these diseases may inadvertently spread the disease while not showing any symptoms.	1
TOTAL	**10**

(b) Using examples, describe the **three (3)** most common measures used to combat disease transmission in Australia. For each measure, identify a factor that may reduce its effectiveness. (10 marks)

Description	Marks
1. Washing hands with soap/detergent removes bacteria or virus from surface of the skin.	1
Prevents direct transmission of contagious diseases such as gastroenteritis, skin infections (school sores), conjunctivitis, cold and flu viruses.	1
Not washing hands after going to toilet or coughing/sneezing into hands while sick can reduce effectiveness.	1
2. Quarantine involves isolation of a person/s infected with dangerous or extremely contagious disease, for a certain period of time, to prevent spreading the disease into a healthy population.	1
Quarantine used for humans, animals and plants that are possibly carrying diseases from other countries.	1
Difficulties arise if people travelling into Australia, showing symptoms of illness, do not report themselves to authorities. **OR** If a pandemic emerges, travel ports require extra staff or specific technology to detect sick passengers.	1
3. Immunisation / vaccination involves the use of specific pharmaceuticals (containing the pathogen that has been inactivated) which are injected into the patient. This stimulates an immune response so any future infection with the pathogen will not cause illness.	1 – 2
Immunisation has the ability to make transmission of disease impossible. An eradicated pathogen cannot re-emerge, unless accidentally or malevolently reintroduced by humans (allowing vaccination or other preventive measures to be discontinued).	1
Immunisation programs can be weakened (the herd immunity weakened) when people choose to not immunise their children. If enough people in a community are not immunised, the herd cannot be sustained and the disease can re-enter.	1
TOTAL	**10**

NB: Part (b) can be also answered using examples for animals other than humans. For example, Myxomatosis in rabbits or Bat lyssavirus. The descriptions regarding cleanliness/physical preventative measures, quarantine and immunisation/herd immunity stay the same: these are the major measures employed to control disease transmission.

END OF EXAM