STUDENT NUMBER/NAME:

Part A

Total marks (15)
Attempt questions 1 – 15
Allow about 30 minutes for this part

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

NOTE: Correct answers are circled.

	A	B	C	D
1	X	⊗		
2		X		
3	X			
4				X
5		X		
6	⊗			X
7			X	
8				X
9		X		
10				X
11				X
12				X
13				X
14		X		
15			X	

13

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STUDENT NUMBER/NAME: .....

1. The Thylacine or Tasmanian tiger was hunted to extinction in the early 1900's. It was superficially quite similar to a wolf or dog, although it had evolved entirely independently of these animals and was in no way related. It was about the size of a collie dog, had a long tail and a wolf like head with short ears and strong jaws and teeth. Its coat is brownish with a series of black stripes across the back. A nocturnal hunter, the thylacine preyed on animals up to the size of small kangaroos.

Wolf

Tasmanian tiger (Thylacine)

What do scientists call this process where two unrelated species evolve to look outwardly similar?

(A) Divergent evolution
(B) Convergent evolution
(C) Competition
(D) Comparative anatomy

2. One form of juvenile diabetes results from destruction of the insulin producing cells in the pancreas. A recent epidemiological study has identified a higher than national incidence of this disease in certain areas of NSW. What does this suggest as the cause?

(A) nutritional
(B) environmental
(C) infectious
(D) auto-immune

3. The release of ADH (anti-diuretic hormone) by the pituitary gland will result in which of the following?

(A) an increase in urine concentration.
(B) a decrease in the permeability of the collecting ducts in the kidney.
(C) an increase in the uptake of urea from the blood.
(D) a decrease in the amount of water reabsorbed into the circulatory system.

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4. Which of the following statements best describes the process of cloning frequently used in farming?

(A) The crossing of two genetically different members of the same species.
(B) Inserting DNA from one species into another to produce desirable characteristics.
(C) Artificially selecting desirable characteristics and breeding animals with these.
(D) The production of genetically identical offspring.

5. Which kind of cell plays a key role in the inflammatory response?

(A) B cells
(B) macrophage cells
(C) memory cells
(D) T cells

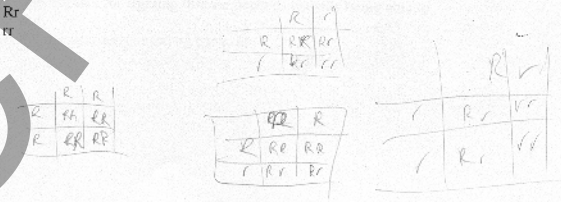
6. Why was Beadle and Tatum's "one gene-one protein" hypothesis altered to the "one gene-one polypeptide" hypothesis?

(A) some proteins are made up of more than one polypeptide chain each controlled by a different gene.
(B) one gene can control the production of many different polypeptides.
(C) genes only control the production of enzymes.
(D) genes are only control the production of polypeptide chains not proteins.

7. In a species of pea plant, round peas are produced much more often than wrinkled peas. The allele for round is given as (R) and the allele for wrinkled as (r).

When two pea plants that both produce round peas are crossed, some of the offspring produce wrinkled peas. What is the only possible genotype for each parent pea plant?

(A) RR, RR
(B) RR, Rr
(C) Rr, Rr
(D) Rr, rr



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8. Which statement best illustrates enantiostasis?

(A) A constant body temperature prevents enzymes from denaturing
(B) Metabolic reaction rates depend on substrate concentration
(C) *Amoeba* osmoregulate by expelling excess water via a contactile vacuole
(D) Oysters remain closed to avoid contact with brackish water as the tide recedes

9. In 1910, a geneticist called Morgan worked with a mutation that arose in his fruit fly stocks. This mutation caused a white eye instead of the normal red eye colour. He crossed a white-eyed male fly with a normal, red-eyed female. All the first generation had red eyes. However, in the second generation all the females had red-eyes, but half the males had white eyes.

Through further breeding, Morgan eventually got females with white eyes as well. This surprised Morgan, and he carried out a reciprocal cross i.e. he crossed a white-eyed female with a red-eyed male. He found that all the female offspring in the first generation were red-eyed, whereas all the male offspring were white-eyed. In the second generation half of the offspring of each sex were red-eyed, and half were white-eyed.

How did Morgan try to explain these results?

(A) He reasoned that the gene for eye colour in fruit flies was co-dominant.
(B) He explained that the gene for eye colour was located on the X chromosome.
(C) He stated that there was no pattern in the inheritance of eye colour in fruit flies.
(D) He explained that this pattern of inheritance was due to a mutation in the first generation of flies.

10. Which of these statements could most likely be attributed to Robert Koch?

(A) life forms originate from other life forms
(B) certain diseases are transmitted by insect vectors.
(C) the body's mechanism for fighting disease depends on cells being able to recognise self.
(D) some specific diseases are caused by bacteria.

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11. Which of the following is NOT an example of homeostasis?

(A) a horse perspiring after running in the Melbourne Cup
(B) the liver removing glucose from the blood and storing it as glycogen
(C) expansion of blood vessels in the skin during exercise
(D) the production of saliva in the mouth while eating

12. In humans, transplanted organs will trigger an immune response that leads to rejection of the transplanted organ.

What is the reason for this immune response?

(A) The transplanted organ contains phagocytes that destroy the recipient's cells
(B) Proteins in the transplanted organ react with the recipient's proteins
(C) Blood in the transplanted organ carries antibodies that cause an immune reaction
(D) The transplanted organ carries markers that are recognised as foreign by the recipient's T-cells

13. Which mechanism is an example of a specific immune response?

(A) the destruction of pathogens
(B) defence adaptations at the point of entry
(C) increased blood flow to a site of infection
(D) production of B and T lymphocytes

14. Which of the following statements is correct about the excretion of waste through the kidneys?

(A) The concentration of urine excreted by terrestrial mammals is fairly constant.
(B) The concentration of urine excreted by fresh water fish is very dilute.
(C) The urine produced by marine fish is very dilute because they are constantly drinking water.
(D) Urine secreted by desert dwelling mammals is generally very dilute, as they need to conserve water.

15. How is oxygen transported around the body by the blood?

(A) attached to haemoglobin in white blood cells.
(B) dissolved in the blood plasma.
(C) carried by the red blood cells.
(D) transported through the lymphatic system attached to cholesterol molecules.

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Part B – 85 marks
Attempt Questions 16 – 34
Allow about 1 hour and 30 minutes for this part

Answer the questions in the spaces provided.

Question 16 (3 marks) **Marks**

Read the newspaper article below and answer the following questions.

BLUE GENE MAY DRAG YOU DOWN
Ben Wyld

A common gene mutation found in more than half the population could explain why people sink or swim when faced with life stresses.

People who have a stress sensitive version of the serotonin transporter 5-HTT gene are more than twice as likely to develop depression after multiple stressful events, according to an international research team.

Led by professors Terrie Moffit and Avshalom Caspi, for the King's College London a team of researchers clustered stressful events-such as loss of a job, death of a loved one, health and relationship problems- among 847 Caucasian New Zealanders aged 21 to 26.

Among those who reported four or more life stresses, 43 per cent had two copies of the short version of the gene developed depression. Of those with one short and one long version gene, 33 per cent developed depression.

Professor Ian Hickie, from the Australian depression initiative beyondblue, said that it was further evidence of the interplay between genes and the environment.

"But simply, having the gene doesn't mean you will have the illness... it is only expressed in key environments," he said.

Sydney Morning Herald Jul 19-20 2003

*Answer the questions on the following page.

Question 16 continues on next page

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Question 16 (continued) **Marks**

(a) Explain why not all people that carry the 5-HTT gene on their chromosome will develop depression. 1

Because not all people who carry the 5-HTT gene will suffer from life stresses which will cause them to express the gene (ie develop depression) ✓ 1

(b) Outline TWO other ways in which the environment may affect the expression of a gene in an individual. 2

Environmental factors may suppress expression of a gene (eg. smoking may retard growth in teenagers) Environmental factors may also change the way a gene is expressed (e.g. pale skinned humans appear darker and more tanned after exposure to the sun) ✓ 2

Question 17 (4 marks)

Both endothermic and ectothermic animals can be found living in a wide variety of habitats.

(a) Explain how an ectothermic animal might respond to the alpine conditions around the Kosciusko ski fields during winter. Explain how this response might assist in temperature regulation. 2

An ectothermic animal (ie one which cannot regulate internal temperature through its metabolism) may respond to alpine conditions by seeking shelter from snow or by curling up in a ball. These responses decrease the animal's exposure to cold weather which could lower their body temperature. ✓ 2

(b) Name ONE Australian endothermic animal. Describe TWO ways this organism might respond to a large increase in the ambient temperature. 2

Red kangaroo: ⊛ licking its paws, as evaporation of the saliva cools it down ✓ 2

⊛ reduction in activity levels, as activity uses energy and produces heat.

1

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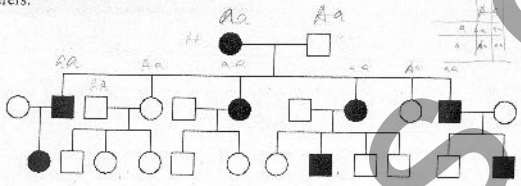
Question 18 (4 marks) **Marks**

The diagram below is a pedigree for albinism in Humans. Albinism can be any one of a number of genetic conditions that cause a lack of pigment in the eyes, skin and hair of sufferers.



Note: solid or "filled in" shapes denote the presence of that trait.

(a) Is the allele responsible for albinism dominant or recessive? Justify your answer 2

The allele for albinism is recessive, as it only occurs when a homozygous recessive genotype occurs (i.e. aa) of the trait and occurs infrequently. ✓ (2)

(b) Explain why a professional dog breeder might use a pedigree. 2

A professional dog breeder may use a pedigree to determine why certain traits may occur in generations of offspring. They may also be used to determine how to obtain offspring with desirable traits. ✓ (2)

4

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STUDENT NUMBER/NAME: .

Question 19 (4 marks) **Marks**

The human body has a number of defences against pathogens.

(a) Outline a defence barrier to pathogens. 2

Mucous is formed in many parts of the body, including the nose and throat. Mucous is a thick, sticky material in which pathogens are trapped. Mucous traps pathogens and foreign particles, thus preventing them from entering the body. ✓ (2)

(b) Compare this defence mechanism to the immune response mediated by B-lymphocytes. 2

Mucous prevents the entry of pathogens, whereas B-lymphocytes deal with pathogens after they enter the body. Also, B-lymphocytes retain a "memory" of pathogens, whereas mucous does not. (2)

Question 20 (7 marks)

During your Biology course you performed an investigation to identify microbes in food or water.

(a) Outline the procedure you used. 3

Three water samples - pond water, distilled water, tap water ~~and ...~~ were collected. Agar plates were then collected. Each agar plate was streaked with water from one of the samples, as shown in the diagram, using an inoculating loop. The inoculating loop was previously cleaned by placing it in a flame. One plate was left as a control. The plates were then sealed with sticky tape and left to develop for a few days. The results were observed and recorded. (3)

Question 20 continues on next page

7

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(b) Identify the dependent and independent variables in your investigation. 2

DEPENDENT: - type of microbes grown

INDEPENDENT: - type of water tested

2

(c) Identify a safety risk in the investigation you performed. 1

The agar plates accumulated a growth of microbes including fungi, which may be pathogenic.

1

(d) Outline a safe work practice you employed to minimise any risks in your investigation. 1

The plates were sealed securely and destroyed after the experiment was performed.

1

Question 21 (4 marks)

(a) Describe the concept of punctuated equilibrium. 2

Punctuated equilibrium is a theory about evolution which states that species remain stable and static until sudden changes occur. Species which can survive through these changes compare to flourish, whereas others die out.

2

(b) Compare punctuated equilibrium with the process proposed by Darwin. 2

Punctuated equilibrium describes sudden changes in the major factor affecting survival of species, whereas "natural selection" (the process described by Darwin) states that gradual changes also affect survival, including availability of food and mates.

2

8

Question 22 (4 marks)

Identify the role of antibiotics in disease management and evaluate their effectiveness in this role.

Antibiotics are substances which kill or bacteria and some other pathogens. They are derived from fungi and bacteria, and act by inhibiting pathogen growth or reproduction. They are very effective and useful in their role of killing other fungi and bacteria, as they work specifically on these pathogens. However they cannot be used to treat ~~viruses~~ virus-caused diseases. This is a disadvantage. Resistance.

on pathogens other than bacteria or fungi.

4

Question 23 (4 marks)

Construct a table to compare the structure of arteries and veins.

Arteries	Veins
carry blood AWAY from the heart	carry blood TOWARDS the heart
carry OXYGENATED blood	carry DEOXYGENATED blood
fairly muscular, ~~not~~ thinner than veins	more thick, muscular and elastic than arteries as they must work against gravity to carry blood to the heart
 tube surrounded by muscular tissue	 cross section
~~contain flaps~~ Valves do not contain flaps	~~do not~~ contain flaps to prevent backflow of blood

4

8

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STUDENT NUMBER/NAME:

Question 24 (4 marks) Marks

Trees can grow to over 120 metres in height. Water and dissolved minerals must move from the roots through the xylem to the tips of the shoots. Materials produced in the leaves must be transported through the phloem to the roots and other parts of the plant. Briefly describe the current theory to account for this movement of materials in the:

(a) Xylem

Xylem carries water upwards in a plant. It is believed that xylem uses capillary action and cohesion to carry water upwards. Xylem vessels are thin so water uses a combination of cohesion forces and capillary action to overcome gravity and travel upwards. 2 transpiration

(b) Phloem

Phloem carries sugars and dissolved minerals up and down the plant. Phloem uses translocation to carry sugars and minerals up and down. Translocation uses diffusion and osmosis as a basis for moving sugars and ions up the phloem tube. sugar pump? active transport 1 2

Question 25 (6 marks)

In mice, black coat colour is dominant over white coat colour. When a white mouse is crossed with a black mouse, half of the offspring produced are black and half are white.

(a) Showing your working, determine the genotypes of the parents. black : BB or Bb white : bb 3

	B	b
b	Bb	bb
b	Bb	bb

Black White

Parents are black and white

∴ Parent 1 : Bb

Parent 2 : bb ✓3

(b) If the black offspring are crossed with one another, what is the genotype ratio and phenotype ratio in the offspring of this cross? 3

	B	b
B	BB	Bb
b	Bb	bb

GENOTYPE : BB : Bb : bb = 1 : 2 : 1 3

PHENOTYPE : black : white = 3 : 1

9 ✓

STUDENT NUMBER/NAME: .

Question 26 (3 marks) **Marks**

Over a long period of time, most of Australia's plants have evolved mechanisms to survive irregular rainfall and very dry conditions. Describe THREE adaptations Australian plants have acquired through evolution to reduce water loss.

Due to Australia's harsh climate, Australian plants have had to develop adaptations to survive and thrive. Some plants, such as Spinifex have long, thin, spiky leaves. This adaptation reduces the surface area available to the environment thus reducing evaporation of water. Similarly, Eucalyptus trees have leaves which hang vertically, which reduces surface area available to the sun, thus reducing water loss. Hairy leaves, and rolled up leaves also increase water retention, allowing plants to survive hot conditions.

3

Question 27 (2 marks)

Describe the effect of temperature on the activity of enzymes.

~~Description~~ Enzymes work best at specific temperatures, which depend on the species (e.g. humans at 37°C). These temperatures allow efficient activity by the enzyme. Higher or lower temperatures may change the enzymes at a molecular level, making them work inefficiently or slowly.

2

5

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Question 30 (3 marks)

Identify ONE product extracted from donated blood and discuss the use of such products. 3

Many products can be extracted from blood, including haemoglobin. Haemoglobin can be extracted from red blood cells. It is important, as it carries oxygen in the blood which is essential for respiration and body function. Haemoglobin is potentially useful for use in patients who suffer from diseases where haemoglobin production is reduced.

red cells white cells platelets plasma

X not used

Question 31 (3 marks)

Over thousands of years, different societies have advocated cleanliness in food, water and personal hygiene.

(a) Identify ONE way that drinking water may be treated to ensure its cleanliness. 1

Water may have chlorine added to it. 1

(b) Explain how this method reduces the risk of infection from pathogens. 2

Chlorination kills of many pathogens in a water supply. This prevents the spread of pathogens who e.g. have entered the water at some point, from reaching us and potentially causing illness. 2

Question 32 (5 marks)

During your Biology course, you performed an investigation to examine plant shoots and leaves to gather evidence of pathogens and insect pests. 5

Describe the procedure you followed and outline your findings.

Plants which were visibly effected by disease or insect pests were collected. Care was taken not to touch the areas of the plant effected as these pathogens or pests may also effect us. The infected areas of the plant were observed using a hand lens and a stereo microscope. 5

It was observed that there were small insects feeding on the stem of one of the plants. These insects were then identified as aphids, a known insect pest.

8

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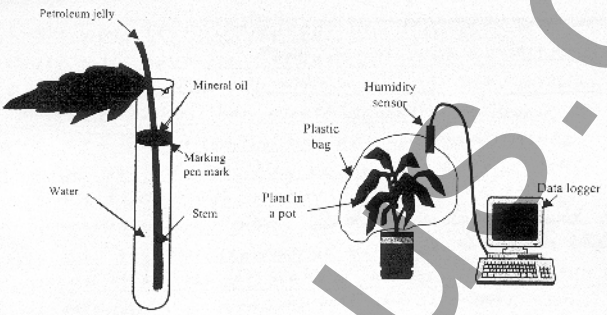
Question 33 (6 marks) **Marks**

The diagram shows TWO methods of measuring the rate of transpiration from leaves.



(a) Measuring transpiration of a single leaf (destructive testing)

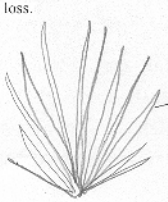
(b) Measuring transpiration of a whole plant (non-destructive testing)

(a) Discuss the differences between these two methods of measuring transpiration and explain why they may produce different results. **4**

The first method is measuring how much water a single leaf uses and transpires. The other method is testing an entire plant to see how much humidity is produced by the plant. There can differences in the amount of leaves which are transpiring, which may account for differences in amount of transpiration. The second method also used a computer to record results, which is accurate for differences in accuracy. 4

(b) Draw a diagram to show an adaptation of a named Australian plant that assists it to minimise water loss. **2**

Spinifex (2)



The thin, spiky leaves reduce surface area available to the environment, thus reducing water loss through evaporation. 6

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Question 34 (8 marks) **Marks**

Using examples, evaluate the impact of current reproductive technologies on the path of evolution. 8

In the past century, many reproductive technologies have been developed and/or advanced. Technologies such as artificial insemination, artificial pollination, cloning and production of transgenic species has allowed scientists to develop, modify and isolate organisms with desirable characteristics. For example, cows and bulls may be chosen to breed in order to produce offspring with desirable characteristics such as fast maturation or coat colour. 2nd technology should be explained

The use of these reproductive technologies has led to an increase of the rate of natural selection. Organisms which are the 'strongest' - or contain the best characteristics - survive and multiply. Other organisms with less desirable or weaker characteristics are ignored and so die out.

The production of transgenic species may lead to the production of species which in time become the strongest. For example, corn and maize are currently being engineered to contain natural insecticides. These modified strains are able to survive environmental impact and so survive and multiply.

The survival of organisms with these strong traits leads to them surviving, multiplying and thriving. The offspring of these organisms may now contain these new desirable characteristics, increasing competition for resources with existing, inferior organisms. good

These reproductive technologies can thus be seen to increase the rate of natural selection and evolution. Although this is positive in the short term, this may be detrimental in the long term. If an event should occur where there is a reliance in a trait which the "superior" organisms do not possess then entire species may be wiped out. In-breeding may also lead to mutations and genome defects.

There is a lack of genetic variability which may be a negative factor in the long term.

5