



TSFX TRIAL EXAMINATION 2018

VCE BIOLOGY – UNITS 3 & 4

SOLUTIONS

SECTION A – MULTIPLE CHOICE QUESTIONS

QUESTION 1	Answer is A	QUESTION 21	Answer is D
QUESTION 2	Answer is C	QUESTION 22	Answer is A
QUESTION 3	Answer is C	QUESTION 23	Answer is C
QUESTION 4	Answer is B	QUESTION 24	Answer is C
QUESTION 5	Answer is B	QUESTION 25	Answer is D
QUESTION 6	Answer is A	QUESTION 26	Answer is C
QUESTION 7	Answer is D	QUESTION 27	Answer is C
QUESTION 8	Answer is B	QUESTION 28	Answer is A
QUESTION 9	Answer is B	QUESTION 29	Answer is B
QUESTION 10	Answer is D	QUESTION 30	Answer is A
QUESTION 11	Answer is C	QUESTION 31	Answer is D
QUESTION 12	Answer is A	QUESTION 32	Answer is B
QUESTION 13	Answer is A	QUESTION 33	Answer is D
QUESTION 14	Answer is B	QUESTION 34	Answer is B
QUESTION 15	Answer is D	QUESTION 35	Answer is A
QUESTION 16	Answer is B	QUESTION 36	Answer is A
QUESTION 17	Answer is B	QUESTION 37	Answer is A
QUESTION 18	Answer is D	QUESTION 38	Answer is D
QUESTION 19	Answer is C	QUESTION 39	Answer is A
QUESTION 20	Answer is B	QUESTION 40	Answer is B

SECTION B – SHORT ANSWER QUESTIONS

QUESTION 1 (6 marks)

- a. Gene regulation or alternative splicing (1 mark).
- b. Exons contain coding sequences for amino acids whereas introns do not contain coding sequences for amino acids (1 mark).
- c. Ribosome (or rough endoplasmic reticulum) (1 mark).
- d. Different signalling molecules resulting in different cellular responses (1 mark) as in different gene expression (1 mark). Different RNA processing involving alternative splicing (or joining of different exons). (1 mark)

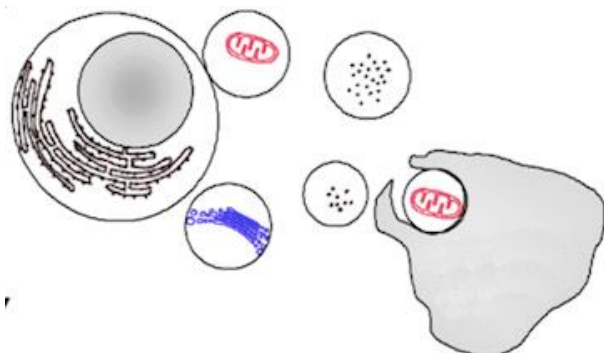
QUESTION 2 (8 marks)

Name of Structure	Role in the <i>lac</i> operon
1. RNA polymerase (1 mark)	The enzyme that performs transcription. (1 mark)
2. Repressor Molecule (1 mark)	It blocks transcription of the operon but stops acting as a repressor when lactose is present. (1 mark)
3. Promoter (1 mark)	The binding site for RNA polymerase. (1 mark)
4. Operator (1 mark)	The binding site of the repressor molecule. (1 mark)

QUESTION 3 (11 marks)

- a. A natural, regulatory process of programmed cell death, (1 mark) resulting in the removal of cells that are no longer needed or that may be a threat to an organism (1 mark) mediated by enzymes (caspases) that cleave specific proteins in the cytoplasm or nucleus (1 mark).
- b. A series of chemical reactions which are initiated by a stimulus (first messenger) (1 mark) acting on a receptor that is transduced to the cell interior through second messengers (which amplify the initial **signal**) (1 mark).
- c. Extrinsic (1 mark) as $\text{TNF}\alpha$ signal is received from outside the cell and binds to receptor on cell surface. (1 mark)

- d. 1 mark for showing phagocytosis of mitochondria or nucleus.
 1 mark for showing apoptotic bodies surrounding other organelles.
 1 mark for labelling phagocyte.
 1 mark for labelling apoptotic bodies.



QUESTION 4 (9 marks)

- a. 1 mark for correct equation



- b. Percentage change in dissolved oxygen (1 mark). This was used as oxygen as a product of photosynthesis (1 mark).
- c. Control so any results could be reliably attributed to the independent variable (carbon dioxide concentration) (1 mark).
- d. Validity refers to if the experiment measures what it intends to measure (1 mark). The method to collect gas involved using a quantitative device so could be considered valid (1 mark) or other answers possible such as size of error bars indicate measurements were not always precise.
- e. The rate of photosynthesis is affected by concentration of carbon dioxide (1 mark). As concentration increases so does the rate of photosynthesis (1 mark) to a certain point, at which the rate is limited by other factors (1 mark).

QUESTION 5 (9 marks)

- a. Variation in features amongst individuals in a population (1 mark).
- b. Master genes control the expression of other genes by turning them 'on' or 'off' in a coordinated fashion (1 mark), whereas structural genes control the actual expression of a protein (1 mark).
- c. DNA is isolated from the two separate species (1 mark).

DNA is heated to break the bonds or separate the strands (1 mark).

Single strands from both species are mixed together and cooled (1 mark).

The resulting hybrid DNA is then reheated and the temperature at which the DNA becomes single stranded is recorded (1 mark).

- d. The temperature DNA becomes single stranded indicates the degree of complementary base pairing (1 mark). The higher the temperature the more closely related the two species are (1 mark).

QUESTION 6 (12 marks)

- a. An effective vaccine injection contains Hepatitis B antigens in an attenuated form which is engulfed by macrophages who then display Hepatitis B antigens on their cell membrane (1 mark). These are identified by T helper cells that may stimulate B cells that have come in contact with the vaccine to undergo clonal selection to produce B memory cells and B plasma cells (1 mark). The plasma cells produce specific Hepatitis B antibodies (1 mark). In future, if person is exposed to the Hepatitis B virus, the antibodies already present along with antibodies produced by activated memory cells quickly destroy the virus (1 mark).
- b. Anti- HBs antibody levels are substantially lower after 3 accelerated doses than after the standard 3-dose schedule (1 mark) hence, a 4th booster dose should be administered to these people at 12 months to provide long-term protection (1 mark).

c.

Structure	Role in Recombinant Process
Isolated Hepatitis B gene	Gene to be recombined into host cell (1 mark)
Plasmid	Vector to transport Hepatitis B gene into host cell (1 mark)
Restriction Enzyme	Used to cut the genes (1mark)

- d. Since the virus itself is not used; it is impossible for a person to become infected by the vaccine. (1 mark)
- e. **Herd immunity** is a form of indirect protection from infectious disease that occurs when a large percentage of a population has become immune to an infection, thereby providing a measure of protection for individuals who are not immune (1 mark). In a population in which a large number of individuals are immune, chains of infection are likely to be disrupted, which stops or slows the spread of hepatitis B and therefore preventing an epidemic (1 mark).

QUESTION 7 (9 marks)

- a. To provide detail about genetic diversity within the same species (1 mark).
- b. Samples were taken from individuals that had already died so no Koala suffered harm in order to complete this research (1 mark).
- c. These genes would produce proteins such as enzymes that would detoxify the eucalyptus leaves or help them detect leaves with a higher water content (1 mark).
- d.
 - (i) Antibiotics either kill or inhibit the growth of bacterial cells (1 mark).
 - (ii) It could also destroy the natural flora which is part of the Joey's innate immune system (1 mark). This means the Joey may then be vulnerable to more infections (1 mark).
- e. These proteins have the potential to be used instead of antibiotics to treat human diseases (1 mark).
- f. Antibodies (1 mark). Provides natural passive immunity to fight disease in Joey's underdeveloped immune system (1 mark).

QUESTION 8 (10 marks)

- a. **Evidence 1:** Changes in Genes (1 mark).

Justification: Supports evolution as in regions associated with cancer or immune function (1 mark).

Evidence 2: Occurred over 4-8 generations since disease outbreak (1 mark).

Justification: Supports rapid evolution as it is inherited and provides a selective advantage to the population (1 mark).

- b. Genetic drift is the random changes in allele frequencies in the Tasmanian Devil populations which are unrelated to natural selection (1 mark). Founder Effect is the loss of genetic variation that occurs when a new population is established by a very small number of individuals from a larger population of Tasmanian Devils (1 mark).
- c. Low genetic diversity means the devils have fewer genetic resources to cope with the selection pressures imposed on it (1 mark). New infectious diseases put strong pressure on their hosts to evolve, leading to rapid changes in resistance or tolerance. (1 mark)
- d. Carbon Dating as fossils are within range 2000 years to ~70000 years and both the necklace and skeleton are composed of organic material (1 mark). An age could be estimated by measuring the amount of carbon-14 present in the sample and comparing this against an internationally used reference standard (1 mark).

QUESTION 9 (6 marks)

- a. Cool conditions in cave preserved the DNA (1 mark) and there was little contamination (1 mark).
- b. Humans evolved in Africa so there has been longer time before mutations (1 mark) that cause genetic diversity to accumulate, therefore greater genetic diversity in Africa compared to human populations in other continents (1 mark).
- c. Bipedalism and tool use (2 marks).
- d. Possible immunity to new diseases found outside Africa or tougher skin and hair (1 mark).