

Paper 2

卷二

SECTION A Human Physiology: Regulation and Control

1. (a) (i) Oestrogen (1)
Progesterone (1)
- (ii) Pituitary gland (1)
- (iii) Human chorionic gonadotropin is secreted by embryo (1)
The hormone delays the degeneration of yellow body (1)
Maintain the secretion of progesterone and oestrogen by yellow body,
maintain the thickness of uterine lining (1)
- (iv) High levels of oestrogen and progesterone together inhibit FSH and
luteinising hormone (LH) secretion. (1)
This prevents follicle development and ovulation. (1)
No ova are released into the oviducts for fertilization. (1)

- (b) (i) (1) At high altitude, the oxygen concentration is low. (1)
Less amount of oxygen can be carried by red blood cells, the blood oxygen level decreases (1)
The body responds by increasing breath rates to obtain more oxygen. (1)
- (2) Less oxygen is supplied to muscles. (1)
The muscles carry out less aerobic respiration and more anaerobic respiration. (1)
More lactic acids accumulate in the muscles. This causes muscle fatigue. (1)
- (ii) Acetazolamide decreases the pH of the blood. The decrease in blood pH is detected by the chemoreceptors at medulla oblongata/ carotid bodies/ aortic bodies. (1)
This stimulates the respiratory centre in the medulla oblongata. (1)
More nerve impulses are sent to the intercostal muscles and diaphragm muscles. (1)
The respiratory muscles contract more frequently and more forcefully. (1)
The rate and the depth of breathing are increased to obtain more oxygen for the brain. (1)

SECTION B Applied Ecology

2. (a) (i) Phytoplankton carries out photosynthesis during the daytime, absorbing light energy and converting it into chemical energy in organic substances. (1)
It serves as a basic food source / energy source of the ecosystem. (1)
Oxygen, the by-product of photosynthesis, can be used by aquatic organisms in aerobic respiration. (1)
- (ii) Predation (1)
Competition (1)
- (iii) Since pH 5.2 is higher than the critical pH of frog, salamander and trout, this pH condition has no direct effect on them. (1)
But at pH 5.2, mayfly, which is the only food source for both frog and salamander, cannot survive. (1)
The frog and salamander die due to the lack of food. (1)
Trout can switch to consume phytoplankton in the absence of mayfly and continue to survive. (1)
- (iv) Caused by acidic gases such as sulphur dioxide and nitrogen oxides. (1)
Sulphur comes from volcanoes emissions, burning fossil fuels in power plants and factories. (1)
Nitrogen oxides mainly comes from vehicle emissions (1)
Sulphur dioxide and nitrogen oxides reacts with water vapour and oxygen to form sulphuric acid and nitric acid (1)
- (b) (i) Chemically and biologically stable (1)
Fat soluble (1)
Cannot be excreted by organism (1)
- (ii) Small fish or prawn fed on dinoflagellates and the toxin is passed to small Fish and prawn. (1)
Big fish fed on small fish and prawn and the toxin is passed to big fish (1)
Ciguatoxin entered and was stored in the fat deposit of fish. (1)
Human ate the grouper and thus ciguatoxin entered human body. (1)

SECTION C **Microorganisms and humans**

3. (a) (i) (1) To release the juice inside the grapes (1)
The juice contains sugar which is the raw material for fermentation (1)
- (2) Yeasts are present on the grape skin (1)
- (ii) (1) Carbon dioxide (1)
- (2) All oxygen had been used up for aerobic respiration after 8 days. (1)
No more oxygen could enter the jar. (1)
The yeast started to respire anaerobically /
carry out alcoholic fermentation to produce ethanol. (1)
- (iii) Yeast was killed (1)
by high concentration of alcohol (1)
- (b) (i) Put the plate in an autoclave (1)
under high pressure and heat (for 15 minutes) (1)
to kill the bacteria and fungi and their spores (1)
- (ii) Any four of the following:
- Always cover the mouth of the microtube with a lid. (1)
Flame the inoculating loop until it is red hot and cool it before use. (1)
After removing the lid from the microtube, flame the mouth of the microtube. (1)
- After removing the bacterial culture from the microtube, flame the mouth of
the microtube and cover it with the lid. (1)
After successfully introducing the bacterial culture onto the surface of the agar
plate, cover the agar plate with the lid immediately. (1)
- (iii) Lower the chance of other microorganisms in the air to (1)
move into the petri dish and contaminate the culture (1)
- (iv) The incubator can be continuously set to an optimum temperature (1)
so that bacteria can grow rapidly. (1)

SECTION D Biotechnology

4. (a) (i) Denaturation (1)
Reaction mixture are heated to 95°C, at this temperature, the hydrogen bond between nucleotides are broken. The DNA denatures. (1)
Primer annealing (1)
The reaction mixture is cooled to 50°C-65°C, this allows the primers to anneal (bind) to the single-stranded DNA by complementary base pairing. (1)
Extension (1)
The reaction mixture is heated to around 70°C, providing optimum temperature for DNA polymerase to pair up free nucleotides to the end of the primers (1)
- (ii) Suspect 2. (1)
The DNA fingerprint of the DNA found in the crime scene matches the DNA fingerprint of suspect 2. (1)
- (iii) The result does not prove the suspect committed the crime. (1)
In the courts, other types of evidence are also taken into consideration. (1)
- (b) (i) A plasmid is a small circular DNA found in some bacteria, independent from the bacterial chromosome (1)
- (ii) Cut the two ends of the DNA fragment and the plasmid with the same restriction enzyme to produce complementary sticky ends (1)
Join the cut DNA fragment and the cut plasmid with DNA ligase to produce a recombinant plasmid (1)
- (iii) Add antibiotic to the culture (1)
Untransformed cells die while the transformed cells survive (1)
Because only transformed cells contain the hygromycin resistance gene (1)
- (iv) Mitotic cell division (1)
It produces daughter cells that are genetically identical to the transformed plant cells (1)
- (v) (1) Night blindness (1)
(2) Toxicity/ Allergy test (1)

甲部 人類生理學：調節與控制

1. (a) (i) 雌激素 (1)
孕酮／黃體酮 (1)
- (ii) 垂體 (1)
- (iii) 人絨毛膜促性腺激素由胚胎分泌 (1)
激素延緩黃體退化 (1)
維持黃體分泌黃體酮和雌激素，維持子宮內膜厚度 (1)
- (iv) 高水平的雌激素和孕激素一起抑制 FSH 和促黃體激素 (LH) 的分泌 (1)
這樣可以防止卵泡發育和排卵。 (1)
沒有卵子釋放到輸卵管中進行受精。 (1)
- (b) (i) (1) 在高海拔地區，氧氣濃度低。 (1)
紅細胞可以攜帶較少量的氧氣，血液中的氧氣水平降低 (1)
身體通過增加呼吸頻率來獲得更多的氧氣。 (1)
- (2) 提供給肌肉的氧氣更少。 (1)
肌肉進行的有氧呼吸較少而無氧呼吸較多。 (1)
更多的乳酸堆積在肌肉中。 這會導致肌肉疲勞。 (1)
- (ii) 乙酰唑胺會降低血液的 pH 值。血液 pH 值的降低是由延髓/頸動脈體/主動脈體的化學感受器檢測到的。 (1)
這刺激了延髓的呼吸中樞。 (1)
更多的神經衝動被發送到肋間肌和橫膈膜 (1)
呼吸肌肉更頻繁，更有力地收縮。 (1)
增加呼吸的頻率和深度，為大腦獲取更多的氧氣。 (1)

乙部 應用生態學

2. (a) (i) 浮游植物在白天進行光合作用，吸收光能並將其轉換為有機物質中的化學能。 (1)
它是生態系統的基本食物來源/能源。 (1)
氧氣是光合作用的副產物，可被水生生物用於有氧呼吸。 (1)
- (ii) 捕食 (1)
競爭 (1)
- (iii) 由於 pH 值 5.2 比青蛙，蟾蜍和鱒魚的臨界 pH 越高，該 pH 條件對他們沒有直接的影響。 (1)
但在 pH 值 5.2，蜉蝣作為兩個青蛙和蟾蜍是唯一的食物來源，蜉蝣無法生存 (1)
青蛙和蟾蜍會因為缺乏食物而死亡。 (1)
在沒有蜉蝣的情況下，鱒魚可以轉而食用浮游植物，並且可以繼續生存 (1)
- (iv) 通過酸性氣體，如二氧化硫和氮氧化物所引起。 (1)
硫來自火山噴發物，在發電廠和工廠中燃燒化石燃料。 (1)
氮氧化物主要來自車輛排放 (1)
二氧化硫和氮氧化物與水蒸氣和氧氣產生化學反應，形成硫酸和硝酸 (1)
- (b) (i) 化學上和生物上穩定 (1)
脂溶性 (1)
不能被生物排泄 (1)
- (ii) 小魚或蝦以鞭毛蟲為食，毒素被傳遞給小魚和蝦 (1)
以小魚和蝦為食的大魚，毒素被傳遞給大魚 (1)
雪卡毒素進入並儲存在魚的脂肪沉積。 (1)
人類吃了石斑魚，因此雪卡毒素進入了人體。 (1)

丙部 微生物與人類

3. (a) (i) (1) 釋放葡萄汁 (1)
果汁中含有糖，糖是發酵的原料 (1)
- (2) 葡萄皮上有酵母 (1)
- (ii) (1) 二氧化碳 (1)
- (2) 8 天後，所有氧氣已用於有氧呼吸。 (1)
沒有更多的氧氣可以進入罐子 (1)
酵母開始缺氧呼吸/進行酒精發酵以生產乙醇。 (1)
- (iii) 酵母被殺死 (1)
通過高濃度的酒精 (1)
- (b) (i) 將板放入高壓釜 (1)
在高壓和高溫下（持續 15 分鐘） (1)
殺死細菌和真菌及其孢子 (1)
- (ii) 以下任何四個：
用蓋子蓋住微管口。 (1)
點燃絕緣環直到其變熱，然後冷卻後再使用。 (1)
從微管上取下蓋子後，點燃微管口 (1)
從微管中移出細菌培養物後，用火焰點燃微管的嘴並蓋上蓋子 (1)
將細菌培養物成功引入瓊脂板表面後，立即蓋上瓊脂板 (1)
- (iii) 降低空氣中其他微生物的機會 (1)
移入培養皿中並污染培養物 (1)
- (iv) 可以將培養箱連續設置為最佳溫度 (1)
使細菌可以快速生長。 (1)

丁部 生物科技

4. (a) (i) 變性 (1)
將反應混合物加熱至 95°C，在此溫度下，核苷酸之間的氫鍵斷裂。DNA 變性。 (1)
引物退火 (1)
將反應混合物冷卻至 50°C-65°C，這樣可使引物通過互補鹼基配對與單鏈 DNA 退火（結合） (1)
擴展 (1)
將反應混合物加熱至約 70°C，為 DNA 聚合酶提供最佳溫度，以將游離核苷酸配對至引物末端 (1)
- (ii) 嫌疑犯 2. (1)
在犯罪現場發現的 DNA 的 DNA 指紋匹配 (1)
嫌疑犯 2 的 DNA 指紋。 (1)
- (iii) 結果不能證明犯罪嫌疑人犯罪。 (1)
在法院中，還考慮了其他類型的證據。 (1)
- (b) (i) 質粒是在某些細菌中發現的小環狀 DNA，獨立於細菌染色體 (1)
- (ii) 切斷的 DNA 片段的兩端，並用相同的限制性酶質粒，以產生互補的粘性末端 (1)
用 DNA 連接酶將切割的 DNA 片段和切割的質粒連接起來 (1)
產生重組質粒 (1)
- (iii) 向培養物中添加抗生素 (1)
未轉化的細胞死亡，而轉化的細胞存活 (1)
因為只有轉化細胞包含潮黴素抗性基因 (1)
- (iv) 有絲分裂細胞分裂 (1)
它產生與轉化的植物細胞在遺傳上相同的子細胞 (1)
- (v) (1) 夜盲 (1)
(2) 毒性/過敏測試 (1)