

CIE A Level Biology 9700 Paper 4 Practice Paper - 100 Marks, 2 Hours

Practice paper · CIE A Level Biology 9700 · Answer booklet 100 · 2 h

Q 1 · Photosynthesis and limiting factors

(a) 2 marks

- thylakoid membranes
- holds photosystems I and II plus ATP synthase

(b) 4 marks

- light intensity is limiting
- faster photolysis gives more ATP / reduced NADP
- more GP reduced to TP
- rate rises until photosystems saturate

(c) 3 marks

- divide the 30-minute value by 30 ($13.5 / 30 = 0.45$)
- multiply by 120 to get 54
- unit cm^3 stated

(d) 4 marks

- photosystems saturated
- limiting factor becomes CO_2 or temperature
- Calvin cycle enzymes / CO_2 fixation are the bottleneck
- rate stays at $0.45 \text{ cm}^3/\text{min}$

(e) 6 marks

- equation balanced for C, H and O
- light and chlorophyll named
- denaturation changes active site shape
- no enzyme-substrate complexes form
- both light and dark stage enzymes affected
- fall is sharp, not gradual

(f) 6 marks

- independent variable: light intensity
- dependent variable: oxygen volume in 30 min
- water bath at 25°C
- same hydrogencarbonate concentration
- same species and shoot length
- three repeats, calculate a mean rate

Q 2 · Genetics, mutation and gene expression

(a) 3 marks

- change in DNA base sequence
- names a type (substitution / insertion / deletion)
- may change a codon and the amino acid sequence

(b) 5 marks

- $1 / 450 \times 100$
- answer 0.222 % (about 0.22 %)
- GAG -> GTG
- Glu -> Val
- beta chain charge changes, sickling at low pO₂

(c) 4 marks

- $450 / 3 = 150$ codons
- stop codon codes for no amino acid
- $150 - 1 = 149$
- answer in amino acids

(d) 3 marks

- genetic code is degenerate
- amino acid sequence unchanged
- tertiary structure and function unchanged

(e) 5 marks

- $9/16 \times 800 = 450$ (both dominant)
- $3/16 \times 800 = 150$ for each single dominant class
- $1/16 \times 800 = 50$ (both recessive)
- four values sum to 800
- ratio matched to phenotype

(f) 5 marks

- crossing over in prophase I between non-sister chromatids
- recombinant chromosomes form
- independent assortment at metaphase I
- $2^{23} =$ about 8.4 million combinations in humans
- random fertilisation adds more variation

Q 3 · Gas exchange and transport

(a) 4 marks

- water and blood flow in opposite directions
- gradient maintained along the lamella
- no equilibrium at the exit (unlike parallel flow)

- blood leaves near saturation

(b) 4 marks

- $70 \times 72 = 5,040$
- divide by 1,000
- answer 5.04
- unit $\text{dm}^3 \text{ min}^{-1}$

(c) 5 marks

- $110 \times 150 = 16,500$
- $16.5 \text{ dm}^3 \text{ min}^{-1}$
- $16,500 / 5,040$
- answer 3.27 (about 3.3 times)
- units correct

(d) 4 marks

- $500 \times 12 = 6,000$
- $(500 - 150) \times 12 = 4,200$
- $4,200 / 6,000$
- answer 70 %

(e) 4 marks

- dissolved CO_2 lowers pH
- Hb affinity for O_2 falls (curve shifts right)
- more O_2 unloaded at the same $p\text{O}_2$
- more O_2 for muscle respiration

(f) 4 marks

- $15 \times 1.34 = 20.1$
- $8 \times 1.34 = 10.72$
- difference 9.38
- $9.38 / 20.1 \times 100 = 46.7 \%$

Q 4 · Energy flow and ecosystems

(a) 3 marks

- $5,000 / 50,000 \times 100 = 10 \%$
- $400 / 5,000 \times 100 = 8 \%$
- both far below 100 % due to respiration, excretion, uneaten parts

(b) 4 marks

- $\text{NPP} = \text{GPP} - \text{respiration}$
- $2,400 - 1,560 = 840$
- $840 / 2,400 \times 100$
- answer 35 % with unit $\text{kJ m}^{-2} \text{ yr}^{-1}$

(c) 5 marks

- about 10 % transfer per level
- losses via respiration, excretion, uneaten parts
- available energy falls exponentially ($0.1^4 = 0.0001$)
- top consumers need large ranges
- too little energy for further levels

(d) 5 marks

- fixation: $N_2 \rightarrow NH_3 / NH_4^+$ by Rhizobium
- nitrification step 1: $NH_4^+ \rightarrow NO_2^-$ by Nitrosomonas
- step 2: $NO_2^- \rightarrow NO_3^-$ by Nitrobacter
- nitrate is the form plants absorb
- both are bacterial, aerobic processes

(e) 4 marks

- photosynthesis exceeds respiration and decomposition
- acid, anoxic bog suppresses decomposers
- organic matter accumulates as peat
- forest biomass stores much carbon

(f) 4 marks

- monoculture homogenises habitat
- pesticides kill non-target species
- fertiliser runoff causes eutrophication
- one concrete mitigation: margins or rotation