

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced Subsidiary GCE

BIOLOGY

2803/01

Transport

Monday

27 MAY 2002

Morning

45 minutes

Candidates answer on the question paper.

Additional materials:

Electronic calculator

| | | | | | | | | | | | | | | |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|
| Candidate Name | Centre Number | Candidate Number | | | | | | | | | | | | |
| | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> </tr> </table> | | | | | | | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> <td style="width: 15px; height: 15px;"></td> </tr> </table> | | | | | | |
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| | | | | | | | | | | | | | | |

TIME 45 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces on the question paper.
- Read each question carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 45.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the stages in any calculations.

| FOR EXAMINER'S USE | | |
|--------------------|-----------|------|
| Qu. | Max. | Mark |
| 1 | 13 | |
| 2 | 17 | |
| 3 | 4 | |
| 4 | 11 | |
| TOTAL | 45 | |

This question paper consists of 10 printed pages and 2 blank pages.

Table 1.1 shows some of the typical components of phloem sap.

Table 1.1

| component | concentration/mg cm ⁻³ |
|----------------|-----------------------------------|
| sucrose | 80 - 160 |
| protein | 1.45 - 2.20 |
| amino acids | 5.20 |
| phosphate ions | 0.35 - 0.55 |
| potassium ions | 2.30 - 4.40 |
| ammonia | 0.03 |
| ATP | 0.24 - 0.36 |
| auxin | 10.5 x 10 ⁻⁶ |

(c) State the form in which carbohydrate is translocated in the phloem.

.....[1]

Translocation is considered to be an active process.

(d) State,

(i) what is meant by an *active process*;

.....[1]

(ii) two pieces of evidence supporting the idea that translocation in the phloem is active.

1

2[2]

[Total : 13]

2 Fig. 2.1 shows red blood cells (erythrocytes) in cross section and surface view.

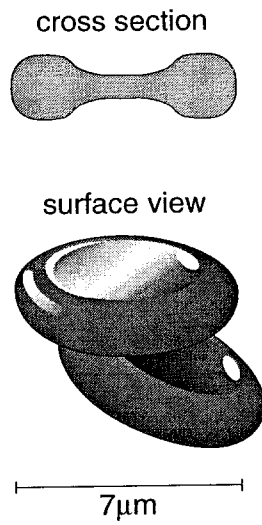


Fig. 2.1

(a) Explain **three** ways in which the structure of a red blood cell is adapted to its function.

- 1
-
- 2
-
- 3
-[3]

Fig. 2.2 shows the dissociation curves for fetal and maternal haemoglobin in humans. The shape of the curves is described as sigmoid (S-shaped).

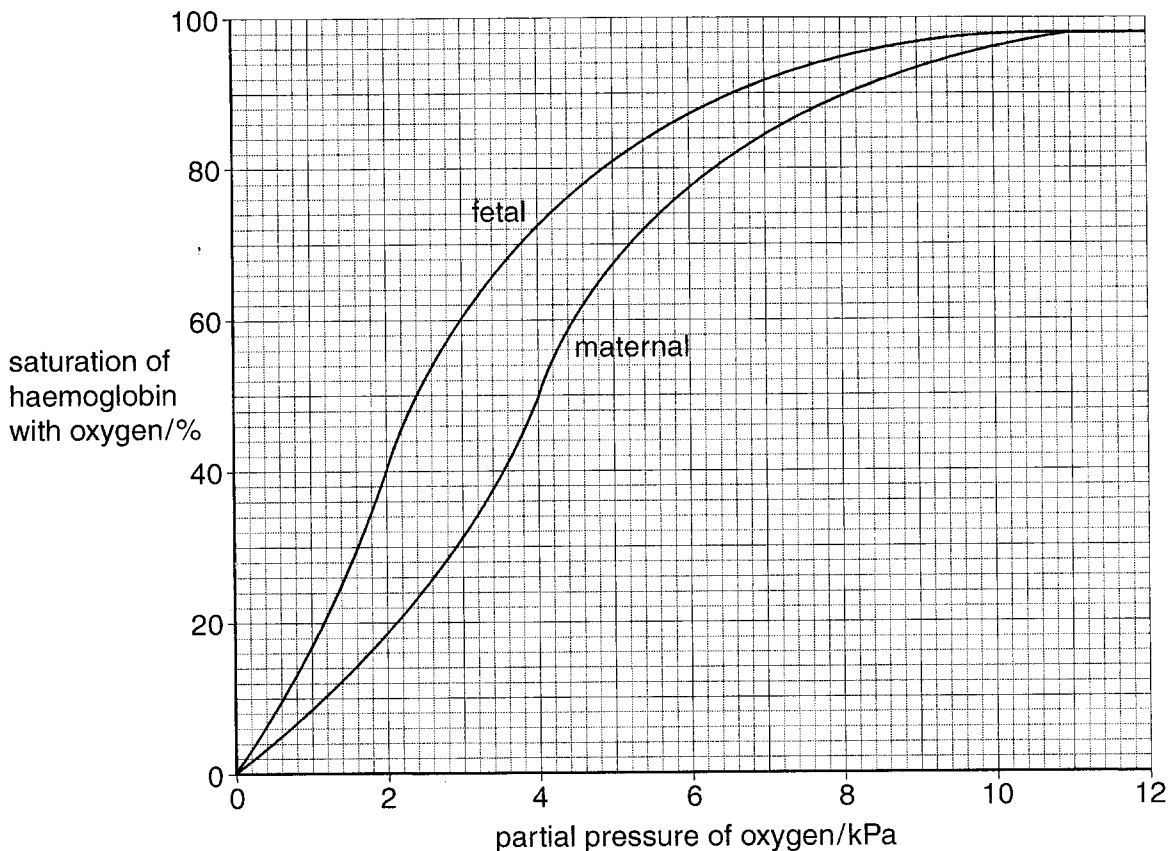


Fig. 2.2

(b) Explain the advantage, in terms of oxygen supply to the tissues, of the fact that the **maternal curve** is sigmoid.

.....

.....

.....

.....[3]

(c) State the difference in percentage saturation of haemoglobin with oxygen between maternal and fetal blood at an oxygen partial pressure of 4 kPa.

.....[1]

(d) Explain why it is essential for the survival of the fetus that the fetal curve is to the left of the maternal curve.

.....

.....

.....

.....

.....[3]

BLANK PAGE

- 4 (a) Complete the following paragraph on the cardiac cycle using the most appropriate word or words.

The sequence of events during the beating of the mammalian heart is called the cardiac cycle. On average there are about such cycles per minute in resting humans. The cardiac muscle is i.e. it can contract and relax without nervous stimulation, but to ensure that the cycle stays in sequence there is an in-built control system. The cycle is initiated in a special part of the muscle in the wall of the atrium called the This sets up a wave of excitation causing the atria to contract. After a delay of about 0.6 sec. the wave of excitation passes to the ventricles via the situated in the septum at the junction of the atria and ventricles. The excitation wave then passes to the base of the ventricles via the causing the ventricles to from the base upwards. [7]

The mammalian circulatory system is described as 'closed' and 'double'.

- (b) State the meaning of the terms

(i) *closed*;

.....

(ii) *double*.

.....

.....

.....

.....

.....[4]

[Total : 11]

Subject: Transport Code: 2803/01

Session: June Year: 2002

Mark Scheme

| | |
|---------------------|-----------|
| MAXIMUM MARK | 45 |
|---------------------|-----------|

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.
2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks ($\frac{1}{2}$) should never be used.
3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.
 - x = incorrect response (errors may also be underlined)
 - ^ = omission mark
 - bod = benefit of the doubt (where professional judgement has been used)
 - ecf = error carried forward (in consequential marking)
 - con = contradiction (in cases where candidates contradict themselves in the same response)
 - sf = error in the number of significant figures
4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.
5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.
6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)
7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.
8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

| | |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Abbreviations, annotations and conventions used in the Mark Scheme | / = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit R = reject () = words which are not essential to gain credit _____ = (underlining) key words which must be used to gain credit ecf = error carried forward A = accept AW = alternative wording ora = or reverse argument |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Question | Expected Answers | Marks |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1 (a) (i) | one mark for each correctly shown/labelled;;;;; | 5 |
| (ii) | cytoplasm in companion cell; (<i>treat presence in sieve tube as neutral</i>) nucleus only in companion cell and only one shown; | 2 |
| (b) | source = where (material) made / stored / loaded (into phloem) + suitable e.g.; A photosynthesis for made sink = where (material) used / respired / stored / unloaded (from phloem) + suitable e.g.; (<i>look for definition plus eg. N.B. storage organs are both source and sink</i>) (<i>max 1 for two correct definitions with no e.g. or two correct examples with no definition</i>) R refs to water or minerals | 2 |
| (c) | sucrose; | 1 |
| (d) (i) | (needs) energy / ATP / respiration involved / AW; | 1 |
| (ii) | ATP present; temperature dependent; oxygen dependent; slowed by (metabolic) inhibitors; ref to speed qualified e.g. faster than diffusion etc; ref to bidirectional flow / AW; many mitochondria / AW; AVP; e.g. correct ref to H ⁺ / pH / K ⁺ / phosphate e.g. loading is against a concentration gradient / AW | 2 max |

[Total: 13]

| Question | Expected Answers | Marks |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 2 (a) | haemoglobin to carry oxygen; no, nucleus / no or few cell organelles / named e.g so, more haemoglobin / more oxygen; large surface area for (increased) gas uptake / exchange / AW; small size / thin cell / AW gives, short diffusion path within the cell / faster diffusion; R easier size just fits capillaries, so slowed for max exchange / close to cells / tissues (for exchange); elastic membrane allows them to squeeze through capillaries / AW; ref to carbonic anhydrase; | 3 max |
| (b) | 1 at pO_2 in lungs / at high pO_2 , O_2 picked up / haemoglobin stays saturated / AW; 2 tissues have lower pO_2 ; 3 oxyhaemoglobin dissociates / AW; 4 (and) O_2 diffuses / AW to tissues; 5 ref steepest part of curve corresponding to pO_2 of tissues; 6 small drop in pO_2 gives a large drop in saturation of haemoglobin / AW; 7 use of figures from the steep area e.g. pO_2 2 – 5 kPa to support this; | 3 max |
| (c) | 22 (%); A 22-23 inc. | 1 |
| (d) | pO_2 in placenta low / same in fetus and mother; maternal oxyhaemoglobin, gives up oxygen / dissociates / AW; oxygen diffuses / AW, across the placenta / to fetus / AW; fetal haemoglobin, picks up O_2 / has a higher affinity / AW; ref to oxygen needed by fetus for respiration / energy release / AW; R energy production | 3 max |

(e)

structure (max 3)

tunica intima / AW

S 1 endothelium;

S 2 squamous / pavement epithelial cells;

S 3 (some) elastic (tissue); *treat muscle or collagen as neutral, but reject*

S3 if both mentioned in the t. intima

tunica media / AW

S 4 (much) muscle;

S 5 elastic (tissue) / collagen;

tunica externa / AW

S 6 collagen / connective tissue; R if muscle included. Elastic neutral

Accept the elastic mark if given in general

S 7 narrow lumen / AW;

S 8 ref elastic nature of aorta / main arteries;

(marks can be gained from a well labelled diagram)

relation to function (max 3)

F 1 smooth endothelium helps flow / AW;

F 2 narrow lumen maintains pressure;

F 3 (thick) muscle / collagen / AW, stops rupture / AW;

F 4 elastic (tissue) allows 'give' / AW;

F 5 ref to role of elastic recoil in moving blood;

F 6 ref to elasticity smoothing out pulsatile flow / reducing pressure;

F 7 ref to vasoconstriction / dilation of muscle with suitable e.g.;

R strong / thick unqualified

6 max

QWC – clear, well organised using specialist terms

1

[Total: 17]

| Question | Expected Answers | Marks |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 3 (a) (i) | correct label (anywhere on the cell); | 1 |
| (ii) | (apoplast pathway) via cell walls (in pathway 3); (symplast pathway) via cytoplasm (in pathway 2); via the vacuoles (in pathway 1); ref to <u>down water potential</u> gradients / from high to low <u>water potential</u> ; ref to osmosis; ref to common pathway(s) qualified; <i>treat apoplast / symplast as neutral throughout</i> <i>penalise only once if descriptions of pathways fail to match key</i> | 3 max |
| | | [Total: 4] |

| Question | Expected Answers | Marks |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 4 (a) | 70 (allow 60 – 80 or any single figure or range within); R if any part of a range is out side 60 - 90 myogenic; <i>treat involuntary as neutral</i> right; SAN / sino atrial node / pacemaker; AVN / atrio ventricular node; Purkyne fibres / (bundle of) His; (<i>A Purkinje</i>) contract; | |
| | <i>reject arterio etc. once if used in SAN or AVN answers</i> | 7 |
| (b) (i) | blood enclosed in vessels / AW; <i>If vessels named, must have two</i> | 1 |
| (ii) | 1 twice through heart; 2 for complete body circuit / AW; 3 ref to pulmonary / described to and from lungs ; 4 and systemic systems / described to and from body; 5 separation of, oxygenated and deoxygenated blood / left and right side (of heart) / two sides / AW; <i>points 1 and 2 need to be stated not just implied</i> <i>credit answers from labelled diagrams</i> | 3 max |
| | | [Total: 11] |