

773 IM 2 T O



231/2 -

BIOLOGY

- Paper 2

Nov. 2017 - 2 hours

Name Index Number

Candidate's Signature Date

Instructions to candidates

- (a) Write your name and index number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) This paper consists of **two** sections; **A** and **B**.
- (d) Answer **all** the questions in section **A** in the spaces provided.
- (e) In section **B** answer question **6 (compulsory)** and either question **7** or **8** in the spaces provided after question **8**.
- (f) This paper consists of **12 printed pages**.
- (g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
- (h) Candidates should answer all the questions in English.

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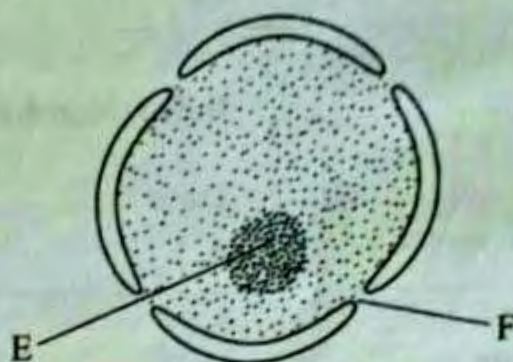
Section	Question	Maximum Score	Candidate's Score
A	1	8	
	2	8	
	3	8	
	4	8	
	5	8	
B	6	20	
	7	20	
	8	20	
Total Score			



SECTION A (40 marks)

Answer all the questions in this section in the spaces provided.

1. The diagram below represents a nucleus.



- (a) Name the structures labelled E and F. (2 marks)

(i) E Nucleolus; ~~Nucleopore~~; Rj. Wrong spelling

F Nuclear pore / Nucleopore;

- (ii) State the function of F. (1 mark)

Facilitates movement of materials in and out of the nucleus; Rj. cell for nucleus.

- (iii) With reference to the nucleus, state one difference between an animal and a bacterial cell. (1 mark)

Nuclear material in the bacterial cell is not enclosed within a membrane / prokaryotic while in animal cell it is enclosed / eukaryotic;

4

(b) Name the plant cell organelle:

(i) that stores chlorophyll

(1 mark)

Chloroplast; *By plural(s) by wrong spelling*

(ii) responsible for intracellular digestion.

(1 mark)

Lysosome; *By plural(s)* 2

(c) State two main functions of the vacuole in the amoeba.

(2 marks)

NP
First Two
i) Feeding (in food vacuole); *Acc. Site for food digestion*
ii) Osmoregulation/Removal of excess water; *(by contractile vacuole)*
iii) Excretion; 2

2. The table below shows variations in the form carbon (IV) oxide is transported in the blood at rest and during physical exercise.

Carbon (IV) oxide transport in blood plasma at rest and during exercise		
Form of transport	Rest (Mol/l)	Exercise (Mol/l)
Dissolved carbon (IV) oxide	0.52	0.97
Bicarbonate ion	12.34	13.68
Carbon (IV) oxide bound to protein	0.26	0.16
Total carbon (IV) oxide in plasma	13.12	14.81
pH of blood	7.42	7.09

(a) Explain why more carbon (IV) oxide is transported in the form of bicarbonate ion.

(2 marks)

Presence of carbonic anhydrase enzyme; which speeds up the conversion of carbon(IV) oxide to weak carbonic acid; which dissociates into hydrogen carbonate ion/HCO₃⁻; (that diffuses out of the red blood cells into the blood plasma). 2

- (b) Account for the high total plasma content of carbon (IV) oxide during exercises.

The body needs high amount of energy; (3 marks)
(for exercise/muscle activity) hence high
respiration rate (more oxygen intake); releasing
more Carbon(IV) oxide (in the blood plasma); 3

- (c) State how one's involvement in the exercises affects blood pH. (2 marks)

The high rate of respiration (during physical exercises
coupled with normal cellular metabolism) results in production
of more Carbon(IV) oxide / faster accumulation of lactic acid;
lowering blood plasma pH / making it more acidic (compared to when one
is at rest);

- (d) Name the protein responsible for the transport of carbon (IV) oxide in the blood. (1 mark)

Haemoglobin; 2
NB: correct formula for pH
NB: wrong spelling

3. The diagram below illustrates the appearance of a plant cell after it had been put in a certain solution.



- (a) Explain the appearance of the cell at the end of the treatment. (3 marks)

The cell is turgid; its cell sap was hypertonic
(compared to the solution in which it was placed); by
osmosis, water moved into the cell / across its semi-permeable
cell membrane; (swelling and becoming turgid) 3



- (b) Explain the results obtained if a red blood cell is subjected to the same treatment. (3 marks)

Red blood cells lack cell wall. Water molecules move across its semi-permeable membrane by osmosis into its hypertonic medium/cytoplasm/cell content. ^(In the cell) Swelling and bursting/hemolysis.

- (c) Explain why transfusion with distilled water is not recommended for a dehydrated patient. (2 marks)

The red blood cells would hemolyse due to lowering of osmotic pressure of the blood below normal level.

4. (a) Explain how the sex of a male child is determined in human beings. (2 marks)

NB: Small letters for X and Y

Male produce sperm cells with X or Y chromosomes. (Females produce ova with containing X chromosomes only). When a sperm containing Y chromosome fuses with an ovum a male child is born.

By crossing:
1) show sexes
2) gametes
3) F1 - correct crossing

X	XX	XY
X	XX	XY

XY - Boy child

- (b) (i) Define the term diploidy. (1 mark)

State of having two sets of chromosomes in a cell/cells; (of an organism) Acc. unicellular organisms for cells.

- (ii) Name the type of cell division that gives rise to diploid cells. (1 mark)

Mitosis;

ii & iii tied

- (iii) Name the type of cells in which the process named in (b) (ii) above occurs. (1 mark)

Body cells/Somatic cells; Acc - body/somatic without cell.



(iv) State the significance of diploidy. (2 marks)

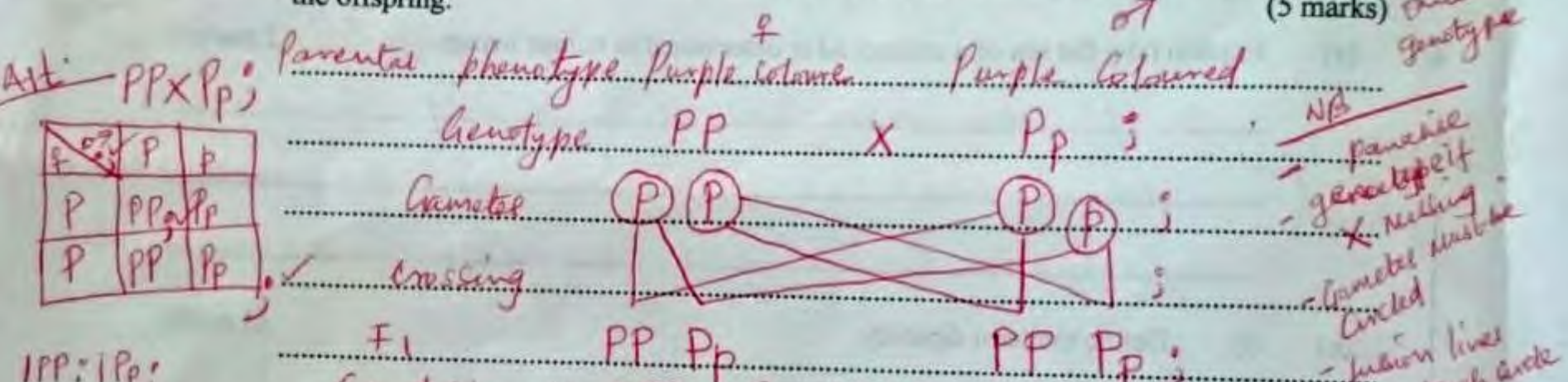
Ensures that the chromosomes/genetic constitution of the offspring is the same as for the parents;
 Ensures perpetuation of a given species, desired/advantageous/favourable/traits/qualities/continuity of species;

(c) Name the hormone responsible for the development of secondary sexual characteristics in human males. (1 mark)

Testosterone; *Rj. wrong spelling*

5. In beans, the gene for purple colour is dominant over the gene for white colour. A pure breeding bean plant with purple colour was crossed with a heterozygous bean plant.

(a) Using the letter P to represent the gene for purple colour, work out the genotypic ratio of the offspring. (5 marks)



1PP : 1Pp
1:1

First Two

(b) State two advantages of using genetically modified varieties in bean farming. (2 marks)

Higher yields;
 Enhanced resistance to diseases/pests;

(c) State how in-breeding leads to reduced hybrid vigour. (1 mark)

Early/faster maturity; *Rj. growth for maturity*
 Enhanced resistance to harsh climatic conditions (drought/extremes in temp);
 Chances of recessive/defective genes being combined increase, hence weaker offspring;

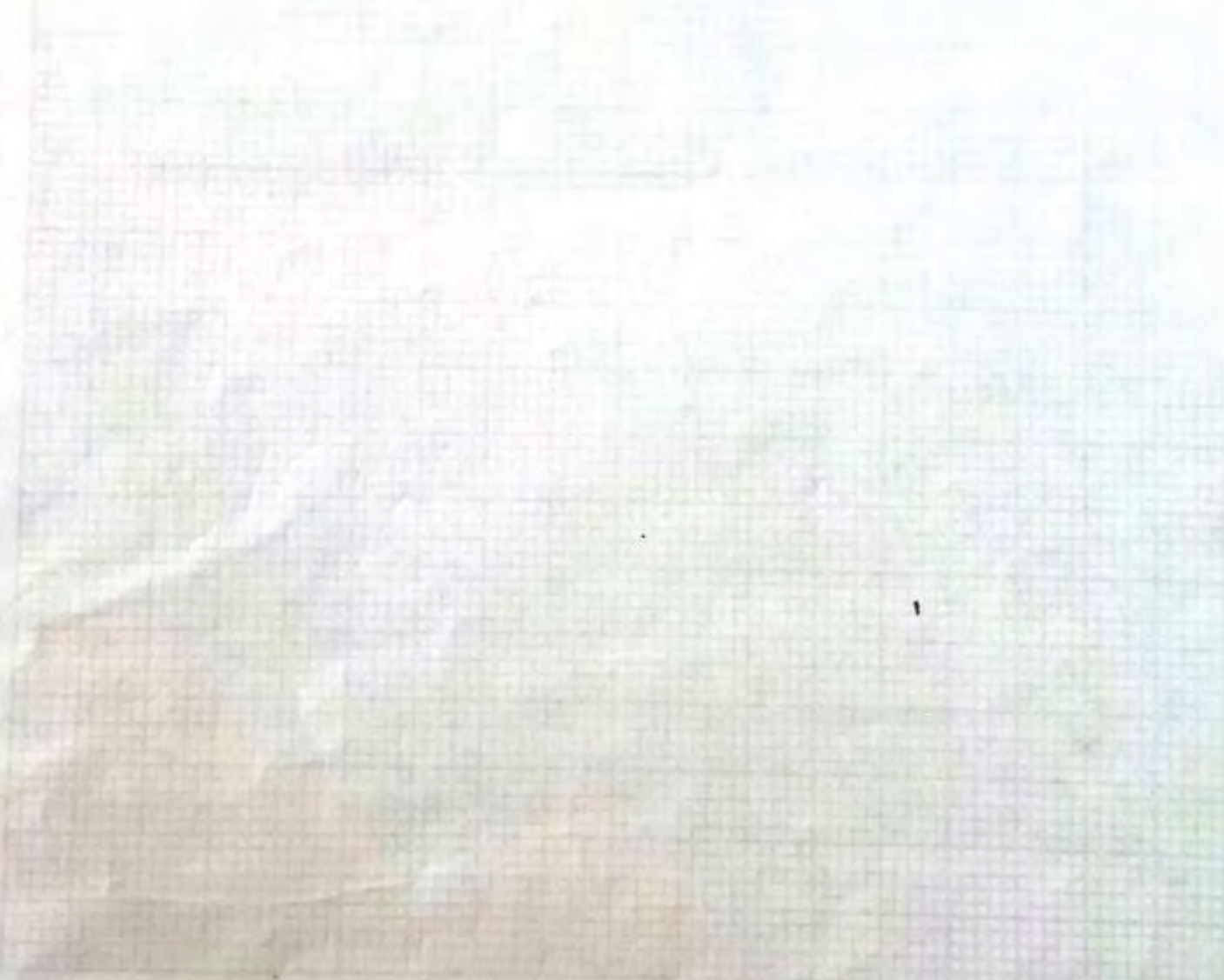
SECTION B (40 marks)

Answer question 6 (compulsory) and either question 7 or 8 in the spaces provided after question 8.

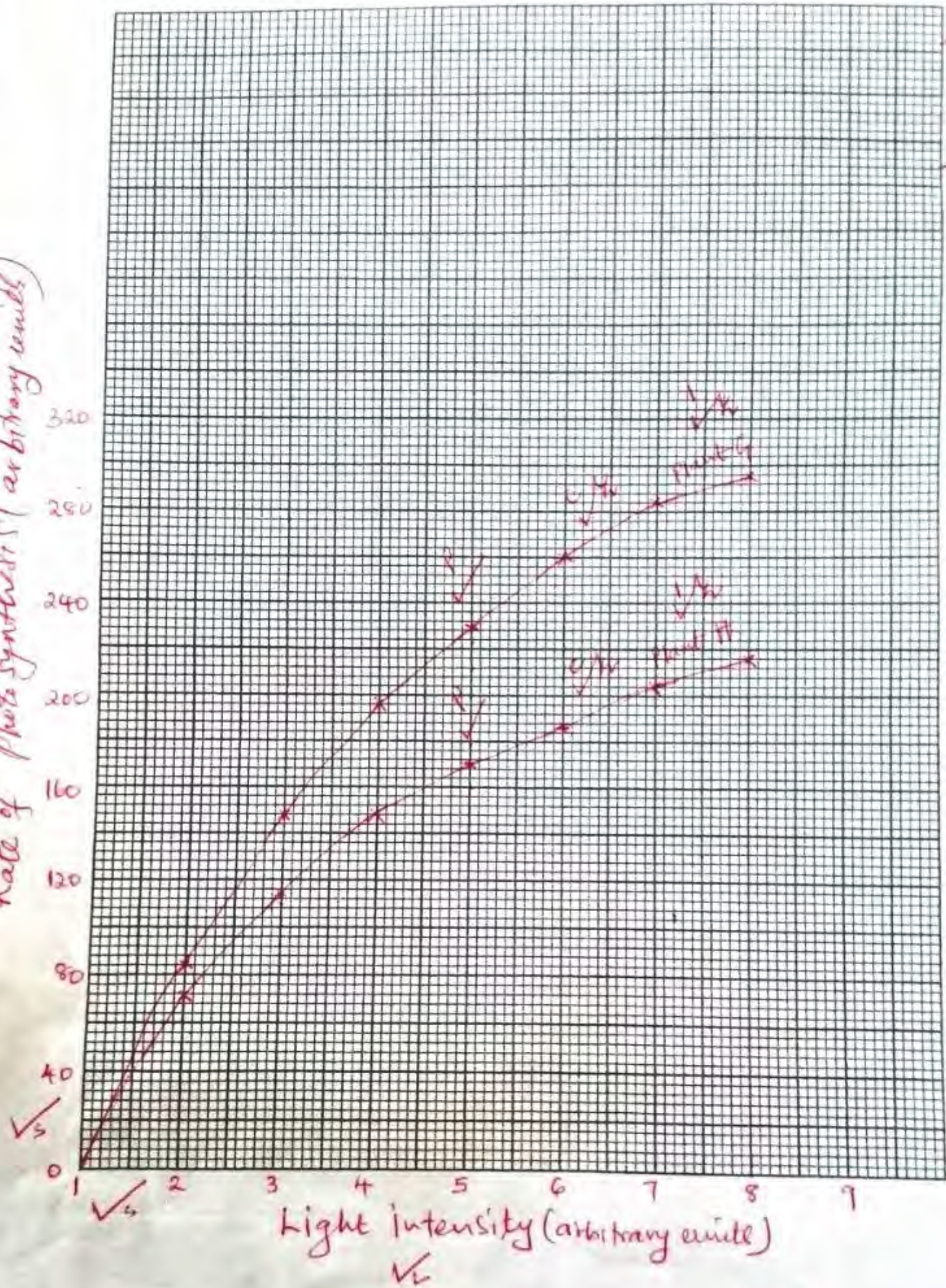
6. In an investigation, two potted plants G and H belonging to the same species were exposed to increasing light intensities at different temperatures, 30°C and 20°C respectively. The rate of photosynthesis was measured for each plant and results recorded as shown in the table below:

Light intensity (in arbitrary units)	1	2	3	4	5	6	7	8
Rate of photosynthesis for plant G at 30°C	0	84	148	196	232	260	284	296
Rate of photosynthesis for plant H at 20°C	0	72	115	148	170	186	204	216

- (a) On the same axis, plot graphs of rate of photosynthesis against light intensity for plants G and H. (8 marks)



Rate of photosynthesis (arbitrary units)



- Calibration
- Control set
- 100% light
- 100% CO₂
- 100% O₂
- 100% H₂O
- 100% N₂
- 100% P
- 100% K
- 100% Mg
- 100% S
- 100% Fe
- 100% Zn
- 100% Cu
- 100% Mn
- 100% B
- 100% Mo
- 100% Ni
- 100% Co
- 100% V
- 100% Cr
- 100% Se
- 100% Si
- 100% Al
- 100% Ga
- 100% In
- 100% Sn
- 100% Pb
- 100% Bi
- 100% Po
- 100% At
- 100% Rn
- 100% Fr
- 100% Ra
- 100% Ac
- 100% Th
- 100% Pa
- 100% U
- 100% Np
- 100% Pu
- 100% Am
- 100% Cm
- 100% Bk
- 100% Cf
- 100% Es
- 100% Fm
- 100% Md
- 100% No
- 100% Lr

Total 8



(b) State the aim of the investigation. (1 mark)

To investigate/compare the effect of (varying) light intensity/temperature on the rate of photosynthesis.

(c) Account for the difference in the rate of photosynthesis in the two plants. (3 marks)

Rate of photosynthesis is higher in plant G (than H); ^{acc. source} because (photosynthesis being an enzymatic process) enzymes were subjected to favourable/optimal temperature (of 30°C); hence more activated, unlike plant H where temperatures were lower

(d) Account for the difference in the rate of photosynthesis in the two plants between the following light intensities: (20c);

(i) 1-4 units (2 marks)

Rapid increase in the rate of photosynthesis ~~increases~~ with the increase in light intensity; due to increase in the light ~~intensity~~ energy for photolysis/formation of ATP molecules;

(ii) 4-8 units. (2 marks)

Slower/gradual increase in the rate of photosynthesis as light intensity increases; because other factors became limiting/Some chlorophyll (molecules) start bleaching;

(e) (i) Predict the rate of photosynthesis at light intensity of 16 units. (1 mark)

No significant increase/Slight increase/No increase/remains constant; acc. values G 298-302 and H 218-222

(ii) Give a reason for your answer in (e) (i) above. (1 mark)

The optimum light intensity has been exceeded/Chlorophyll could be destroyed;

- (f) State one internal and one external factor that could be limiting in the investigation. (2 marks)

Internal - Chlorophyll/enzyme concentration;
 External - Carbon(IV) oxide concentration/amount of water;

7. Explain the importance of protecting the forest ecosystem with reference to the following: (20 marks)

- (a) climate change
 (b) biodiversity
 (c) biotechnology
 (d) water conservation
 (e) pollution.

8. Describe how the mammalian eye is structurally adapted to its function. (20 marks)

7 (a) Climate Change - Promote (regular) rainfall/Precipitation/Prevent (4 marks) desertification;

- Acts as wind breakers;
- Keep earth temperatures cool/produce global warming;
- keeps biological/biochemical cycles going eg hydrological/Carbon/Nitrogen/Phosphorus/Impulse cycles;

(9 marks) b) Protect Biodiversity

- Conserve diverse flora and fauna; Source of oxygen;
- Conserve genetic variety;
- Prevent extinction of rare ~~some~~ species;
- source of research; Employment;
- Aesthetic/Attracting tourists (for foreign exchange);
- Have impact on culture/religion/politics;
- Shelter for other organisms/Man;

(6 marks) c) Biotechnology

- Provide timber (when regulated);
- Manufacture of medicines/directly used as medicines;
- Source of food/food products;
- Provide fuel (when regulated);
- Provide paper and related by-products (when regulated);

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- products used in other industries eg. Tannin, wax, rubber, oil, honey;
- Acc other appropriate examples eg Popaen, gum

9) Climate Change

- Promote (regular) Rainfall/Precipitation/Prevent desertification;
- Act as wind breakers (A.C. Wind break);
- Keep earth temperature cool/Reduce global warming;
- Keeps biological/Biochemical cycles going/Hydrological/C/N/P/S cycles;

b) Biodiversity

- Conserve flora and fauna;
- Conserve genetic variety;
- Prevent extinction of rare species;
- Source of research;
- Source of employment;
- Shelter for man/other organisms;
- Aesthetic/Attract tourists (foreign exchange);
- Source of Oxygen;
- Have impact on Culture/religion/Politics;

c) Biotechnology

- Manufacture of medicines/directly used as medicine;
- Source of food/food products;
- Provide fuel; etc.
- Provide Paper and related products;
- Provide timber;
- Provide products used in other industries eg. Tannin, wax, rubber (Latex), oil, honey, Papain, gum etc;

d) Water Conservation.

- Increased ground water/High water tables;
- Adds into rivers/lake/permanency in existing water bodies reservoirs;
- Water towers/Water Catchment;

e) Pollution

- Minimize Soil Pollution / ensuring cover against run-off / wind erosion / Land denudation;
- Trees / vegetation Clean the soil surface by absorbing nutrients from decomposing matter eg sewage;
- Large scale cleanup of polluted air (Removal of CO_2 / dust);
- Muffle / reduce noise pollution;

8. Structure

Adaptation to function

1 Sclera/sclerotic layer;	Contain tough/inelastic (collagen) fibres/fibrous to protect/maintain shape of eyeballs;
2 Cornea;	Transparent to allow light to pass through // Curved to refract/bend light towards retina; (Acc. Convex shape for curved, R, biconvex)
3 Conjunctiva;	(Thin) epithelium to protect the cornea // transparent to allow light to pass through // Goblet cells glandular for secretion of mucus for lubricating
4 Choroid/choroid layers;	Rich in blood vessels/capillaries/highly vascularised to supply the retina/the eye with nutrients/Oxygen/to remove metabolic waste products // Has (black) pigmented cells to prevent reflection of light within the eye // (R: arteries & veins for blood vessels)
5 Ciliary body;	Has muscles that contract and relax/are contractile to alter the shape of the lens during accommodation // Has secretory cells/glandular to secrete aqueous humour;
6 Lens;	Transparent to allow light to pass through // elastic to allow adjustment of the shape of lens // Biconvex to refract/focus light onto retina;
7 Iris;	Has radial and circular muscles to alter the size of the pupil/to control amount of light entering the eye // pigmented to absorb light and prevent it from reaching onto the retina;
8 Aqueous humour;	Clear/transparent to allow light to pass through // Fluid (to exert hydrostatic pressure) to maintain the shape of the eyeball // refract light rays onto retina // contains nutrients glucose and amino acids for nourishment of the cornea/lens (R: Oxygen also)

Correct spellings

Adaptation to function

Structure

9. Vitreous humour	clear/translucent to allow light to pass through // Is a fluid (to exert hydrostatic pressure) to maintain the shape of the eyeball/ refract light rays onto the retina;
10. Retina;	Contains cones and rods (photoreceptors) to perceive light/ where the image is focused/ formed // Has cones and rods, cones for colour vision/ bright light vision and rods for vision in dim light;
11. Optic nerve;	Has sensory neurones/ nerve cells that transmit impulses to the brain;
12. Fovea (Centralis) (R: Yellow spot)	Has numerous cones (only) for accurate vision/ visual acuity;
13. Pupil;	A hole/aperture/opening on the iris that lets in light;
14. Suspensory Ligaments;	Is anelastic ^{fibres} fibrous to hold the lens in position;
15. Blind spot;	Absence of photoreceptors/ cones and rods to allow passage of blood vessels/ exit of optic nerve;