

# TRANSPORTATION IN PLANTS AND ANIMALS

## MARKING SCHEME

### 1. 1989 Q3 P1

- i) Biconcave shape gives a greater surface area for absorption of oxygen.
- ii) Contain hemoglobin, which has high affinity to oxygen.

### 2. 1989 Q11 P1

- a) To investigate the effect of light on the rate of transpiration
- b) –More water was lost in the light than the dark. Rate of transpiration was greater in the light than in the dark. This is because the stomata are full open in light but less open or closed in the dark. In light photosynthesis takes place and water is used, while in the dark no photosynthesis takes place hence no water is used.

### 3. 1991 Q2 P1

- Blood is pumped to the arteries by the heart at high pressure; blood pressure in veins is reduced by capillary resistance; arteries have narrow lumen/veins have wide lumen which maintain pressure/reduces pressure; arteries have muscular walls which generate high pressure; veins have less muscular walls which reduce pressure

### 4. 1992 Q6 P1

- P<sup>H</sup> of blood plasma is not altered/homeostasis is maintained; within the red blood cells there is an enzyme( carbonic anhydrase) which helps in fast loading/combination and offloading/dissociation of Carbon dioxide.

### 5. 1992 Q17 P1

- i) Skeletal muscle

$$\frac{23000 - 1100}{1100} \times 100 = \frac{21900 \times 100}{11000}$$

$$= 1990.9\%; \text{ Acc. } 1991\%$$

- ii) Gut

$$\frac{400 - 1300}{1300} \times 100 = \frac{(-)900 \times 100}{1300}$$

$$= 69.2\%; \text{ Acc } 69\%; \text{ Acc } (-)$$

$$\frac{4000 - 1300}{1300} \times 100 = 208\%$$

- b) At rest- There is more blood flow through the gut than skeletal muscles; because less physical(metabolic activity) at rest hence less glucose and oxygen(materials)required hence more blood available to carry away food since digestion is higher at rest.

During strenuous activity- More energy is required in skeletal muscle; Hence more glucose and oxygen is required by muscles; there is need for faster removal of wastes and heat; hence more blood required

- c) –Stronger contractions;faster contractions/increased heart beat.
  - Powerful pumping
- d) i) At rest – body temperature is normal hence less blood is required near the surface of the skin.
  - ii) During light exercise
    - The body temperature increase and more blood flows to the skin/vasodilation is necessary to take away excess heat
- e) –water, urea/nitrogenous wastes, salts. Rej nitrogenous material.

**6. 1993 Q6 P1**

-Defence against disease/disease causing micro-organism/production of antibodies: Clotting: Temperature regulation/distribution.

**7. 1994 Q1 P1**

- Valves

**8. 1995 Q11 P1**

- (a) A – Epidermis  
B – Pith
- (b) C – Transport manufactured food / translation; Rej. Digested food  
D – Produces new cells/ divides to give new cells. Accept secondary Thickening/ growth/ produces phloem & xylem.  
E- Transport minerals salts/ minerals/ salts alone
- (c)
  - Xylem in central/ Star shaped
  - Phloem in arms of xylem
  - Root hairs present in root / has pilferous layer
  - No pith in root

**9. 1996 Q17 P1**

- (a) Anaemia/ low blood volume/ loss of iron/ low red blood cells/ low Haemoglobin; leading to low oxygen; loss of nutrients and dehydrations.
- (b) Blood clotting
- (c) Transfusion; taking fluids) eating iron rich food stuff/ taking iron tablets.

**10. 1996 Q19 P1**

- (a) K- Root hair  
L- Xylem vessel

(b)

Water moves from the soil into the root hair by osmosis; because concentration of cell sap is higher than water in the soil; the cell sap in the root hair is diluted, thus making it less concentrated than neighbouring cell; therefore water moves into the neighbouring cell; it is actively secreted into structure L.

(c) Active transport/ diffusion

**11. 1997 Q4 P1**

- Lignified thickened to prevent collapsing (Acc. Strengthened add strength)
- Narrow to facilitate capillary:

**12. 1997 Q13 P1**

- (a) Strong air/ winds  
High temperature  
Low humidity; accept dry conditions/ sunlight
- (b) Absence of leaves/ stomata absent  
Transpiration; / little transpiration
- (c) Arid/dry/ desert/ accept semi- desert  
Reason-Low rate of water loss; accept more/ a lot of water loss  
Wet/Moist/aquatic  
Reason-High rate of water/ high rate of transpiration /acc. A lot of water loss

**13. 1998 Q1 P1**

Blood has no antigens and does not cause agglutination (with other types)

**14. 1998 Q18 P1**

- (a) If axes reversed allow marks for identification of curves only max 2  
Correct scales  
Correctly levelled axes  
Curves reject broken lines for curves
- (b) *0-1 hour.*
  - i) Acc constant/low/below normal levels in blood; No/little digested foods/glucose from the intestines/gut/alimentary canal/absorption.
  - ii) *1-2 hours*  
Sharp increase in concentration of glucose in blood; (more) absorption of glucose; after digestion of the meal.
  - iii) *2-4 hours.*  
Glucose concentration declining/decreasing; less glucose being absorbed; (more) glucose being converted to glycogen in the liver/tissue/used for (tissue) respiration.
  - iv) *5-7 hours.*  
Concentration of glucose stabilizes/constant/ this is the normal glucose level concentration in the blood.
- (c) The concentration of glucose in the iliac vein is lower than in the hepatic portal vein because it hasn't been stored in the liver to be used respiration. Portal vein because most of it was stored/used up by the liver/other tissues/respiration.

(d) Proteins take longer to digest.

**15. 1999 Q1 P1**

Active transport  
Diffusion  
Mass flow  
Cytoplasmic streaming                      any two

**16. 1999 Q2 P1**

Lactic acid is poisonous to tissue and must be removed.  
To increase supply of oxygen to tissues.

**17. 1999 Q14 P1**

a) Trypanosome  
b) i) Locomotion  
c) Sleeping sickness/trypanosomiasis  
d) -Orally ingested including boring through bites  
    -Sexually; cuts and wounds (contaminated) needles syringes/surgical instruments; contaminated blood transfusion.

**18. 2000 Q11a, b P1**

(a) X- Spongy mesophyll ( cell) layer  
(b) Y - Cuticle

**19. 2001 Q3 P1**

A, B, AB, O

**20. 2001 Q8 P1**

(a) Open/ lacuna  
(b) (i) Hepatic portal vein  
(ii) Pulmonary vein

**21. 2002 Q6 P1**

Oxyhaemoglobin acc.  $\text{HbO}_2$  /  $\text{HbO}$

**22. 2002 Q16 P1**

(a) R. Sieve pore  
    S- cytoplasmic strand, cytoplasmic filaments rej. Proto plasmic strand)  
    Cell labeled T- Companion cell  
(b) Translocation (L is tied with structures)  
(c) Thickened and lignified.

**23. 2003 Q9 P1**

a) Lignin  
b) Phloem

**24. 2004 Q2 P1**

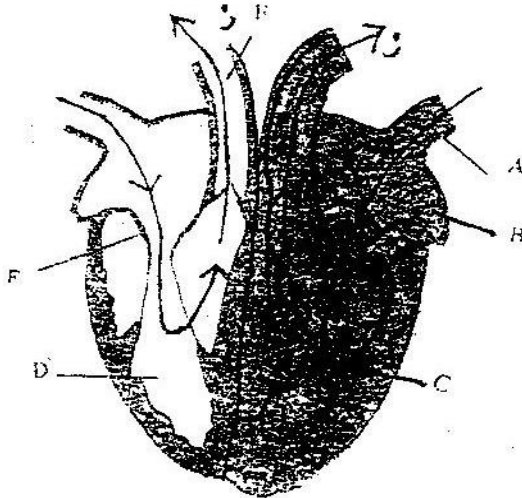
- Natural immunity is inherited / transmitted from parent to offspring;
- Acquired immunity is developed after suffering from a disease / thought vaccination.

\* Accept innate / inborn for natural Rej. Born with it.

**25. 2004 Q13 P1**

- (a) A Pulmonary vein  
 B Left atrium I auricle  
 E Tricuspid valve  
 F Pulmonary artery

(b)



- c) The left ventricle 'C' pumps blood a longer distance to all parts of the body; while the right ventricle 'D' pumps blood to a shorter distance/ to the lungs; therefore the left ventricle has thicker walls to generate exert more pressure.

**26. 2005 Q3 P1**

Xylem vessels transport water and mineral salts from the roots to the leaves. Phloem tissues transport manufactured food/soluble organic products of photosynthesis within the plant.

**27. 2005 Q9 P1**

It does not easily dissociate and therefore reduces the capacity of haemoglobin to transport oxygen to the tissues.

**28. 2005 Q14 P1**

a) Transpiration

b) i) The leafy shoot should be from herbaceous plant

- Cut off the last few centimetres of the stalk under water
- All the air in the capillary tubule should be expelled
- Jelly should be applied around the stem around the rubber bung.
- The end of the capillary tubing should rest in beaker of water.

- ii) Avoid air bubbles.
  - For continuity of the flow of water
  - Jelly should not touch the xylem vessels because it might block they xylem.
  - To avoid introduction of air bubbles in the xylem.
  - For continuity of water uptake.

- c)
  - Temperature
  - Humidity
  - Wind
  - Atmospheric pressure
  - Light intensity
  - Availability of water

**29. 2006 Q7 P1**

- (a) Thrombosis/Varicose veins/Arterial sclerosis/ Antheroma  
Atherosclerosis  
Accept cerebral vascular thrombosis

- (b)
  - Regulation of the body temperature
  - Regulation of pH of fluids
  - Defense against disease – causing organism/ pathogens/ infection.
  - Prevent excessive bleeding by enhancing clotting/ prevent excessive loss of blood

**30. 2006 Q4 P2**

- (a) Root
- (b) Presence of root hairs  
Presence of endodermis  
Xylem star shaped at centre  
Phloem at arms of the xylem
- (c) J- Epidermis  
K- Phloem  
L – Xylem
- (d)
  - Absorption of water
  - Absorption of minerals salts

**31. 2006 Q8 P2**

Water exists as a thin film in the soil between soil particles. The concentration cell sap is greater than that of the surrounding solution in the soil; Thus drawing water molecules across the cell wall and membrane into the root hair cells; by osmosis; water drawn into the root hair cell dilutes the cell sap/ makes it less concentration than that in the adjacent cell into the cortex cells. (By osmosis); across the endosperm by active transport; into the xylem vessels (of the root); Then conduct the water up into the xylem (vessels) of the stem; into xylem of leaves. Water is pushed/ rises up the stem by root pressure ( in the xylem

vessels) water would rise by capillary; cohesion, and adhesive forces; water moves as a continuous and uninterrupted water column in the xylem (vessel) up the tree to the leaves. As water vaporizes from the spongy mesophyll cells; their cells sap becomes more concentrated than adjacent water flows into the cells from other surrounding cells; which in turn takes in water from xylem vessels within the leaf veins. This creates a pull / suction force/ transpiration pull that pulls a stream of water from xylem vessel in the stem and roots; the transpiration pull maintains continuous column of water from the roots into the leaves (transpiration stream).

**32. 2007 Q9 P1**

Absence of cuticle to allow diffusion of water

- Thin walled to reduce distance of diffusion
- Elongated to increase surface area for absorption of water and mineral salts
- Presence of large vacuole to increase concentration gradient between cell sap and soil water

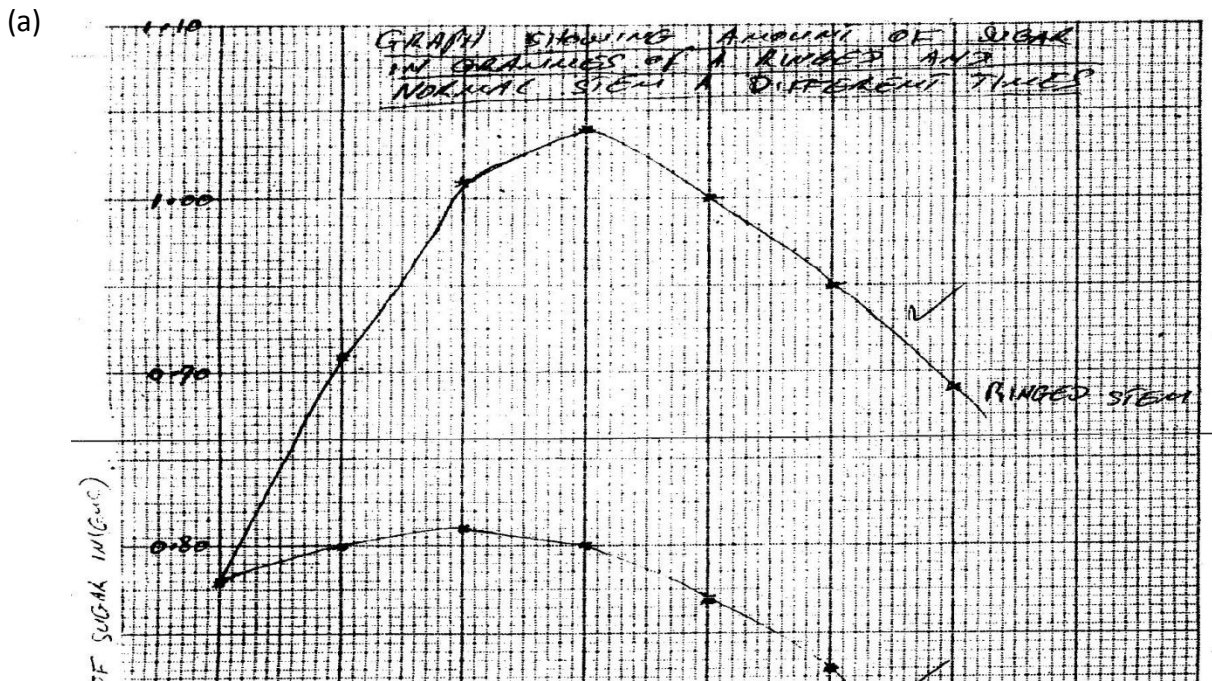
**33. 2007 Q10 P1**

- (a) Phloem tissues
- (b) K- companion cell- L – sieve tube
- (c) Supply nutrients and energy to the sieve tubes

**34. 2007 Q11 P1**

- (a) Presence of valves
- (b) Have biconcave shape to increase surface area for absorption of gases
  - Thin capithelium to reduce distance of diffusion of gases
  - Absence of nucleus and other organelles
  - To increase packaging of haemoglobin
  - Presence of red pigment haemoglobin that has high affinity for oxygen

**35. 2007 Q6 P2**



- (b) (i) 15: 45  
(ii) 12:45
- (c) 0.79 + 0.02 grammes
- (d) The food that had been manufactured the previous day had been converted to soluble sugars and was being translocated to other parts of the plant.
- (e) 0645 hours and 15 45 hours
  - There was low concentration of sugars early in the morning as there was little translocation
  - As day progresses the light intensity increases and more food is manufacture thus more translocation increasing concentration of sugars
- (ii) 15 45 hours and 0045 hours
  - The light intensity is decreasing reducing rate of photosynthesis. Less food is manufactured hence less is translocation
  - As it turns dark there is no photosynthesis reducing concentration of sugars translocated.
- (iii) Sieve plates
- (f) Cytoplasm strands
- (g) -Amino acids
  - Soluble fats/ lipids

**36. 2008 Q20 P1**

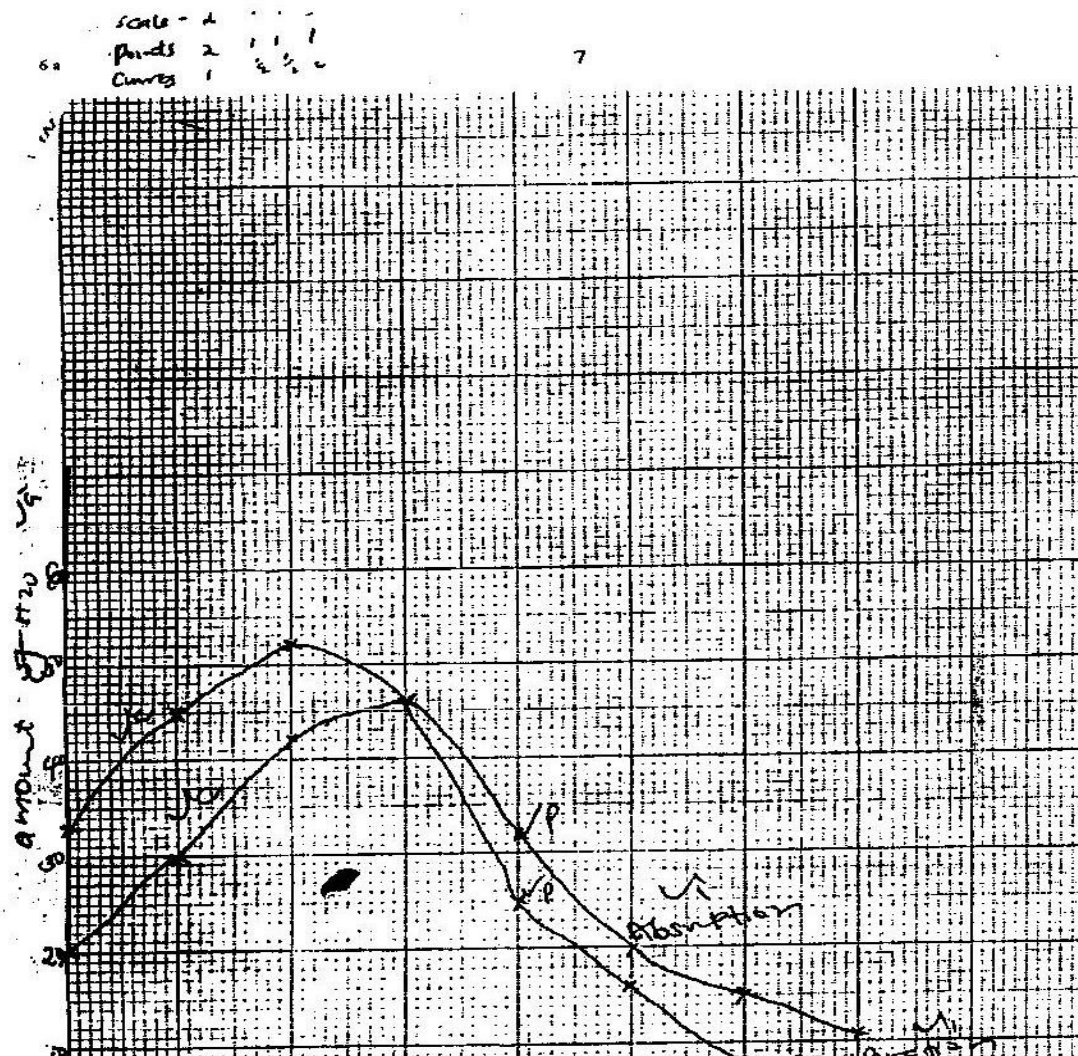
- (a) Circulatory system in which blood passes through two capillary systems before flowing back to the heart/ blood passes only once through the heart to complete its circuit in the body.
- (b) Fish/ earthworm/ ringworm



(c) Ostium/ Ostia

37. 2008 Q6 P2

(a)



- (b) 17.001- 19.99 hrs
- (c) (i) Transpiration  
1100 – 17000 (rapid) ( in the rate of transpiration) due to high light intensity/ high temperature
- (ii) 17000 – 0300 hrs decrease (in the rate of transpiration) due to low light intensity/ absence of light/ in temperature.
- (iii) Absorption  
11.00 – 1900 hrs. Increase (in the rate of atmosphere) of water to replace water lost- through transpiration.
- 1900 – 0300 hrs; decrease ( in the rate of absorption of water) due to the fact that rate of transpiration has declined
- (d) Both transpiration and absorption decrease accept decrease
- (e) Wind; light, atmosphere pressure, humidity; temperature  
Temperature - at high temperature the rate is higher/ at low temperature the rate is Low.
- (f) Wind- rate of transpiration is high when it's windy/ lower when air still  
Humidity – when humidity is low, the rate of transpiration is faster/ when its High the rate of transportation is low  
Pressure- the rate is high at low atmosphere pressure at high atmosphere pressure the rate is low.

**38. 2009 Q6 P1**

- (a) (i) Dicotyledonae; *Rej: dicotyledonous*
- (ii) Vascular bundles arranged in a ring / presence of vascular  
*Rej: Pith – Not visible also found in the root of monocots*

*Rej: Intra vascular bundle*

(b) (Divides to) give rise to secondary thickening (growth/increase in growth /diameter/width of stem/gives rise to new / additional xylem and phloem tissues.

39. 2009 Q28 P1

(a) **Arteries**

**Veins**

(b) Arteriosclerosis; / *Rej. Atheroma* – due to the deposition of cholesterol which makes blood vessels narrow

- Thick muscular walls - No valves (except at bases of Pulmonary artery and aorta) - Narrow lumen	This muscular walls:/  Have valves/  Wide lumen; /
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- 40. 2009 Q29 P1**  
(When humidity in high the air around the leaf gets saturated with water vapour hence) less space for water vapour from the leaf to occupy / low saturation deficit / low diffusion gradient / the difference in concentration of water vapour in the atmosphere and in the air spaces is greatly / highly reduced.
- 41. 2010 Q14 P1**  
Charcoal in limited supply of air produces carbon(ii)oxide; which combines with haemoglobin forming carboxyhaemoglobin; which is stable/ does not dissolve reducing capacity of the haemoglobin leading to suffocation/ death;
- 42. 2010 Q23 P1**
- Absence of nucleus, increase of space for packaging haemoglobin(for carrying oxygen)
  - Possession of haemoglobin which has high affinity for oxygen
  - Bi-concave shape creates large surface area for combining with oxygen
  - Ability to change shape/flexible to enable them pass through capillaries.
  - Have carbonic anhydrate which increase CO<sub>2</sub> transportation
  - Are numerous/many to be able to carry max amount of oxygen
  - Has plasma membrane which allow rapid diffusion of gases
- 43. 2010 Q28 P1**  
Arteries have thick muscular walls; veins have thin and less muscular walls  
Arteries have narrow lumen, veins have wider lumen  
Arteries have no valves except at junction with heart; veins have valves at regular intervals.
- 44. 2010 Q2 P2**
- a) **P** – tissue fluid / intercellular fluid/ space.  
**Q** – Venule.
  - b) i) Glucose, oxygen; Rej: formulae  
ii) Carbon (IV) oxide, water; Rej; carbon dioxide OR Formula.
  - c) Blood entering the arteriole has a higher pressure; than that leaving the venule, the pressure force water and small solutes (molecules) in blood to go through capillary wall forming tissue fluid; Nutrients / oxygen in tissue fluid move into the tissue cells by diffusion; Acc. Nutrients like glucose/ mineral salts/ vitamins/ fatty acids & glycerol. ( Acc 2 nutrients)
  - d) Red blood cells/ proteins/platelets; Acc one example of protein e.g. globulin.
- 45. 2011 Q16 P1**

a) Weakened / defective valves in veins; causing blood / body fluids to accumulate; leading to swelling. (2 marks)

b) When exposed to air they disintegrate/rupture/burst; releasing thromboplastin (2 marks)

46. 2011 Q20 P1

a) X;

b) X has fewer stomata; most stomata in leaf X are concentrated on the lower side; (1 mark)

47. 2011 Q7a P2

(a) Explain how structural features in terrestrial plants affect their rate of transpiration. (13 marks)

- Plants in arid / semi-arid/ desert habitats have leaves covered with thick / waxy cuticle; that are water proof / impermeable to water; allowing for reduced rate of transpirations; sunken stomata; in some desert / semi – arid areas, plants have water vapour accumulating in the plants; most plants have few or no stomata on the upper surface of the leaf/most stomata are on lower surface sheltered from direct sunlight; some plants have small stomata / stomatal size; thus reducing transpiration rate. Plants with small needle like / spine; leaves expose less surface area; reducing transpiration rate. Leaves with shiny surfaces; reflect light resulting in reduced leaf temperature; thus reducing the rate of transpiration some plants have leaves covered with hair / scales; which trap a layer of moisture; reducing rate of transpiration. Plants growing in wet habitats / mesophytes have a thin layer of cuticle; which allows high rate of transpiration; broad leaves; to exposure large surface areas; many stomata on both leaf surface; have large stomatal aperture;

48. 2012 Q11a P1

(a) can contract continuously without fatigue;

Their contraction is started by muscles themselves (and not nerves)myogenic;

49. 2012 Q23 P1

(a)Collenchyma; cellulose

(b) xylem; lignin

50. 2012 Q28 P1

Open	Closed
Blood flows in haemocoel/sinuses Blood cavity/coelum directly in contact with cells Blood flows under low pressure	Blood confined in vessels Blood flows at high pressure Blood has pigment for transport of O <sub>2</sub> and CO <sub>2</sub>

Lacks pigment for transport of O <sub>2</sub> and CO <sub>2</sub>	
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**51. 2012 Q8 P2**

(a) Allergic people are hypersensitive to materials like dust/pollen grains/some foods/some drugs/some pollutants/fungal spores/feathers/fur/strong perfumes; Examples Asthma, Hay fever, any other specified correct example. An allergic reaction is a hypersensitive response to an antigen by the body immune system; the body immune system responds by overproducing antibodies; against harmless antigens; the antigen-antibody reaction occurs on the surface of the body cells; which burst open; and release histamines; Histamines cause inflammation/itching/swelling/pain/breathing difficulties/constricting of bronchi/dilation of capillaries/excessive secretion of mucus/anaphylaxis/diarrhoea/vomiting/sneezing/coughing/wheezing etc

(b) In bright light; stomata are (fully/wide) open; exposing air spaces in the leaf to the atmosphere; this in turn increases water loss by evaporation through the open

stomata. High (environmental) temperature; increase the rate of evaporation from the leaf surface/stem surface; thus more water vapour leaves cells due to increased diffusion gradient;

In windy day; air around the leaf/stem is carried away reducing water vapour around the leaf/stem; increasing diffusion gradient between leaf stem air spaces and the atmosphere.

In low humidity/when the atmosphere is less saturated with water vapour; more water vapour will move from the leaf/stem air spaces into the atmosphere due to increased diffusion gradient.

Low atmosphere pressure; increases diffusion gradient between atmosphere and the leaf/stem increases rate of evaporation; leading to increased rate of transpiration

Availability of water; causes turgidity of guard cells hence stomata open; increasing the rate of transpiration.

