

BIOLOGY
K.C.S.E PAPER 231/3 2006
PRACTICAL
MARKING SCHEME

- 1 (a) Cervical region/ neck region (1 mk)
- (b) K - Atlas
M - Axis
N - Cervical vertebra (3 mks)
- (c) Wide neural canal
Absence of Centrum
Small neural spine (3 mks)
- (d) spinal cord (3 mks)
Odontoid process
- (e) S - Facets for articulation (2 mks)
T - For passage of blood vessels
- (f) Occipital condyle (1 mk)
- (g) U - Post zygapophysis
Y - Odontoid process
R - Centrum (3 mks)
2. (a) (i) The stem from L₁ is firm/ hard/stiff
The stem from L₂ is soft (2 mks)
- (ii) Solution L₁ is hypotonic to the cell sap
Water moved into the stem cells by osmosis
Cells of the stem become turgid;
Solution L₂ is hypertonic
Water moves out of the cells by osmosis making the cells flaccid
(5 mks)
- (b) (i) Material in L₁- The slit opens wider, and they bend backwards.
Material in L₂ The strips remain close together (3 mks)
- (ii) In L₁ cells in the inner surface/ cut surface enlarged more because they took in more water; (by osmosis) than the outer cells which have cuticle.

3. (a) (i) Set A - Normal conditions/ in light
(ii) Set B - In the dark
(iii) Set C - Subjected to unilateral light (3 mks)
- (b) SET A SET B
(i) Green plants Pale yellow plants
(ii) Large leaves Small leaves
(iii) Short stems Long stem
(iv) Thick stems Thin stems (4 mks)
- (c) (i) Etiolation (1 mk)
(ii) To reach light (1 mk)
- (d) Positive phototropism (1 mk)
- (e) (i) Auxins migrate to the dark side
(ii) Causing faster growth of cells on the dark side
(iii) Resulting in the curvature of the shoot towards the source of light (3 mks)

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1. (a)
- 3 (a) Leaves with serrated margin/ toothed/ saw like/ teeth like
 4 (b) Leaves opposite
 5 (a) Leaves pinnate (3 mks)

(b)	Specimen	Identity	Steps followed
	P	Compositae	1b, 5a, 6a
	Q	Nyctaginaceae	1a, 2a, 3b
	R	Commelinaceae	1a, 2b
	S	Bigoniaceae	1b, 5b
	T	Papilioncea	1b, 5a, 6b
	U	Malvaceae	1a, 2a, 3a,4a
	V	Verbenaceae	1a, 2a,3a, 4b

(12 mks)

- 2.
- (a) Food Substance: Starch (1 mk)
 Procedure: add (2) drops of iodine to solution P (1 mk)
 Observation: Bluish black/ blue/ black (1 mk)
 Conclusion: Starch present (1 mk)
- (b) Food substance: Reducing sugar (1 mk)
 Procedure: (1 ml) of solution P, add equal amount of Benedict's solution/S
 Warm/ heat/ boil the mixture (2 mks)
 Observation: Green to yellow to Orange/ Brown (1 mks)
 Conclusion: Reducing sugar present (1 mk)
- (c) Procedure: place a drop of solution P into a filter paper. Gently dry over flame
 (2 mks)
 Observation: No permanent translucent spot/ mk (1 mk)
 Conclusion: Lipids absent (1 mk)

- 3.
- (a) J - Lungs
 K - Gills (2 mks)

(b) Gaseous exchange/ External respiration (1 mk)

(c)

- ❖ X - Ring of cartilage
- ❖ Y - Lung
- ❖ Z - Heart (3 mks)

(d) (i) 1: Gill rakers
2: Gill arch/ bar
3. Gill filament (3 mks)

(ii)

- ❖ Rake like/ projections for trapping solid particles
- ❖ Rake like/ pointed / tooth like/ needle like projections for trapping/ sieving/ filtering solid particles from reaching and damaging the filaments
- ❖ Many/ numerous/ long filaments to increase surface area for gaseous exchange (4 mks)

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1. (a) A. Liver
 B. Stomata
 C. Spleen
 D. Small intestine/ Eleum
 G. Duodenum
- (b) E Stores faeces/ undigested material/ indigestible materials
 F It contains/ harbours/ store bacteria which produces enzymes/ cellulose which digest cellulose/ digestion of cellulose bacteria that digest cellulose.
- (c) Diagram
- (d) (i) Male
 (ii) Presence of the prostate gland/ testes/ seminal vesicles
- (e) (i) $\frac{9(\text{cm})}{15(\text{cm})} = 0.6 / \frac{3}{5}$ $\frac{9.1\text{cm}}{1(\text{cm})} = 0.606$
 $9.2 \text{ cm} / 15 (\text{ cm}) = x \cdot 0.613$
 NB: Units must be given
 NB: mg x 0.6 – 0.613
- (ii) Length on photo $14.6 + 0.1 = 14.5 \text{ cm} / 14.60\text{c}/14.7$
- (iii) At mg x 0.6 = $\frac{14.5 \text{ cm}}{0.6} = 24.16 \text{ cm} / \frac{14.6 \text{ cm}}{0.6} = 24.33\text{cm}$
 $\frac{147 \text{ cm}}{0.606} = 24.257 \text{ cm}$
- at mg x 0.61 = 14.5 cm $0.61 = 23.77\text{cm}$ $14.6\text{cm}/0.61 = 23.934$
 $\frac{14.7\text{cm}}{0.61} = 24.098$
- (iv) at mg x 0.613 = $\frac{14.5 \text{ cm}}{0.613} = 23.654$
 $\frac{14.7 \text{ cm}}{0.61} = 24.098$
 $14.7/0.613 = 23.980$
 Length range = 23.654 – 24.5 cm

2.

Substance	Food substance being tested for	Procedure	Observations	Conclusion
S	Proteins	To food substance/ S add sodium hydroxide; add copper sulphate solution	Colour changes to purple/ violet	Protein present
T			No Colour change/ Remains blue	Protein absent
U		Colour changes to (light) purple; violet because its for the extreme	(trace) protein present	

NB. Wrong spelling of reagent or percentage and also observation and conclusion
Wrong chemical formula by underlining

3.

Specimen	Mode of dispersal	Adaptive features
K	Animals (s)	Hooks, persistent calyx alome sauce with hook
L	Animal (s)	Fleshy/ juicy/ succulent
M	Wind	(parachute of hairs/ pappus/ hairy/ hairlike projection
N	Wind	Winged (perricap)/ winglike extension
P	Animal/ animal	Fleshy; juicy
Q	Self mechanism/ self explosive mechanism	Lines of dehiscence/ lines of weaknesses

b). ii) Axile/central; axil/axial. Free central

c). Seed/endocarp.

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<u>BONE</u>	<u>IDENTITY OF THE BONE</u>	<u>WHERE FOUND</u>
1.(a) K	- Humerus	Fore limb/foreleg/ front leg/upper arm/ upper fore limb
L	-Scapula/ shoulder blade	rej Hand/ fore arm Shoulder/ pectoral region
M	- Femur	rej- pectoral girdle Hind limb/ hind leg/ thigh/ Upper hind leg
N	Tibia/ shin bone	Hind limb/ hind leg/ lower hind limb
P	Ulna – Radius	Forearm/ fore limb/ arm/ Lower/ fore leg/ front leg
	Rej only one answer	
(b)	1. Condyles Rej- Condyle	
	2. Glenoid cavity	
	3. Head/ head of femur	Rej. Head of humerus
	4. Patella groove	Rej: groove alone due to omission
	5. Ulna/ shaft of Ulna/ shaft	
(c)		
(i)	Scapula/ shoulder blade	
(ii)	Ball and socket ii tied to i	
	Posterior end	
(i)	Radius and ulna	
(ii)	Hinge ii tied to i	
(e)	Muscle attachment limit the movement of radius and ulna/ limit the movement at the joint prevents overstretching O.W. He limits movement in more than one place.	

2.

Substance	Food substance being tested for	Procedure	Observation	Conclusion
P	Reducing sugar	Add Benedict's solution / boil / warm in hot water bath)	Green to yellow to orange/ brown	Reducing sugar present
Q	Reducing sugar	Add Benedict's solution. Heat/ Boil/ warm in hot water bath)	No colour change/ blue colour remains	Reducing sugar absent/ reducing sugar present after hydrolysis
	Non Reducing sugar	Add dilute hydrochloric acid ix, boil, cool Add sodium hydrogen carbonate until fizzing stops add benedict's heat	Green to yellow to orange/ brown	Presence of non reducing sugars/ reducing sugar present after hydrolysis Rej. Reducing sugar present Rej Reducing sugar present

Deny for wrong spelling of benedict's solution

- *In the table, mk reducing sugar, add benedict's solution, heat any once*
- *Led non- reducing sugar under play indication se*

3. (a) Mk 11st three clockwise from top

First labeled on one or more seedlings

(b) i. epigeal germination

(ii) Cotyledons above ground/ soil

(c) W- Grow in dark/ insufficient light/ absence of light

X- Grown in light/ sufficient light/ adequate light

(d) (i) Etiolation

(ii) To reach light/ search/ look / get/ obtain/ seek light

W

X

(e) - Long intermode/ stems/ tall plant

- Short intermodes/ stem/ plant

- Thinner stem

- Thicker stem

- Small leaves

- Big/ large leaves

- Yellow or light green leaves

- Green leaves/ stems/ cotyledons/

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- stem/ cotyledons seedlings
- (f) Seedlings subjected to unilateral/ unidirectional source of light causing auxins to migrate / diffuse to the dark side of the shoot/ high concentration of auxins on dark side; causing faster growth on that side than the lit side/ faster cell elongation/ faster cell enlargement/ faster cell growth on the side than the lit.

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1. (a)

	Procedure	Observations	Conclusion
Iodine test	Add (a few drops of) iodine (to liquid in the beaker);	No change in colour/Brown/yellow /orange colour of iodine retained;	Starch absent;
Benedict's test	(To 2 ml of the liquid from the beaker),(2 ml of) Benedict's solution is added. The mixture is heated/boiled/ warmed in a water bath;	The solution acquires a brick red colour; Yellow/orange/brown/ reddish brown. NB. Colour sequence must be correct	Reducing sugar is present;

	Procedure	Observations	Conclusion
Iodine test	Add (a few drops of) iodine (to contents of visking tubing);	Solution acquires a blue black colour/blue/black/bluish Black colour;	Starch present;
Benedict's test	(To 2 ml of the liquid from the beaker), (2 ml of) Benedict's solution is added. The mixture is heated/boiled/warmed in water bath;	The solution acquires a yellow/orange/brown/ reddish brown colour;	Reducing sugar is present;

(2 mks)

Observations and conclusion that is repeated to be awarded once in (a) and (b).

(c) The visking tubing is semi-permeable/selectively permeable; allowing (the small) reducing sugar molecules to diffuse/move pass through; but (not the large molecule of) starch; (3 mks)

- NB.
- (i) spelling of reagents must be correct.
 - (ii) Quantities of reagents and test materials if stated must bear correct units e.g. ml/cm³
 - (iii) Procedure for Iodine to be awarded once in (a) and (b) Procedures, observations and conclusion for Benedict's Test to be awarded once in (a)/or (b).
 - (iv) Award if student refers to Iodine as solution E, Benedict's solution as solution F and contents of visking tubing as L.
 - (v) Deny all mks if student writes a wrong food substance in the Test column e.g. Non-reducing sugar.

2. (a)	String	Chamber	Blood vessel	
	Blue	right ventricle;	pulmonary artery;	
	Green	left ventricle;	(branches of)	
	Cream	right	aorta; vena cava;	
	1	auricle/atrium left	pulmonary vein	(8 mks)

(b) (Inter-ventricular) Septum; (1 mk)

(c) 4 is thicker than 5, because the latter (forms the wall of the chamber that) pumps blood to the lungs and

4 (forms the wall of the chamber that) pumps blood to all the other parts of the body;
Distance be compared i.e. longer if the parts are not named. (1 mk)

(d) X Vein(s);

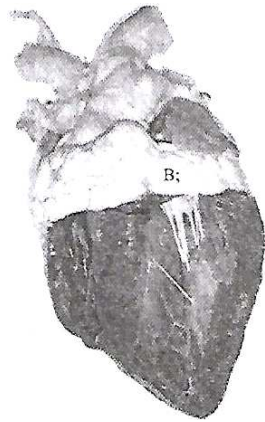
Reason: It has thin walls/ less muscular walls;

(4 mks)

Y Artery (Arteries);

Reason: It has thick walls/more muscular walls;

(e)



NB: (i) Accept any point of the region mked.
(ii) Labelling rules to be adhered to e.g. continuous line, no arrow head to structure.

(1 mk) (a)

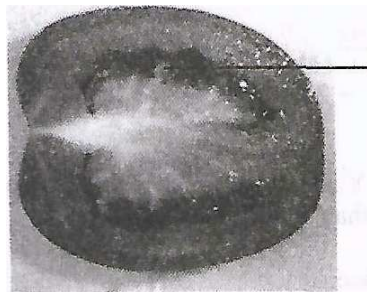
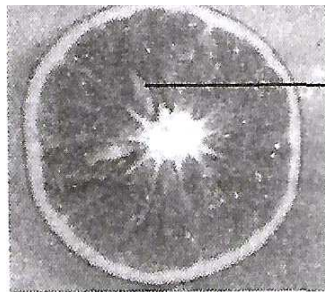
Q Marginal;

R Axial/axile/central;

S Central;

(3 mks)

(b)



(2 mks)

(c) 6 Epicarp/Exocarp;
7 Seed; Ace cotyleone(s)

(5 mks)

8 Edocarp;

9 Mesocarp;

10 Remain of flower stalk/pedicle/fruit stalk;

(d) Q

Self (dispersal)/self explosive/explosion (mechanisms/explosive mechanism/self Dispersed);

- Reason Presence of sutures/lines of weakness/dehiscence (along which it splits);
 T By animal(s)/animal dispersed;
 Reason The fruit is fleshly succulent/brightly coloured/fleshy mesocarp (and animals eat and drop the seed on another place far away from the mother plant); (4 mks)

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1.

- K pectoral fin
 L Dorsal fin
 M Anal fin
 N Pelvic fin

b) the size of scissors on the photograph is 4.6
 the length of fish on the photograph is 13.6

Mg = Image length
 Actual length

Actual lengths of fish is $\frac{13.6 \times 12.5}{4.6} = 36.96$ cm 3mks

ci) Yawing –Dorsal fin 3mks

ii)Pitching –Pectoral fin; Pelvic fin 3mks

- di) R Gill rakers
 S Gill bar
 T Gill filaments

ii)R Sharp / numerous /pointed /arranged closely in a row to trap solid that can damage the filament

S-Riding /firm to hold gill filaments in place

T- Numerous to increase surface area for gaseous exchange / thin to reduce the distance for gaseous exchange /vascularized to transport respiratory gases away from the respiratory surface / moist to dissolve oxygen for diffusion 3mks

Total = 16 mks

a)Leaf D –Class dicortyledonae

Reason – Network of veins / presence of petiole

Leaf E- Class monocotyledonae

Reason – Parallel venation /presence of leaf sheath

b)Broad and flat to offer a large surface area for photosynthesis 4mks

Thins to reduce distance over which carbon IV oxide diffuses to reach the mesophyll cells

Rich supply of veins to transport water to photosynthetic cells

Presence of chlorophyll to absorbed light for photosynthesis

C i)

U Xylem

V Phloem

W Cambium

ii

Ross section of F

- I. No pith
- II. Vascular bundles scattered
- III. Vascular bundles numerous
- IV. Cambium absent
- V. Cortex absent
- VI. Small vascular bundles

First (5mks)

Total = 15 mks

Cross section of G

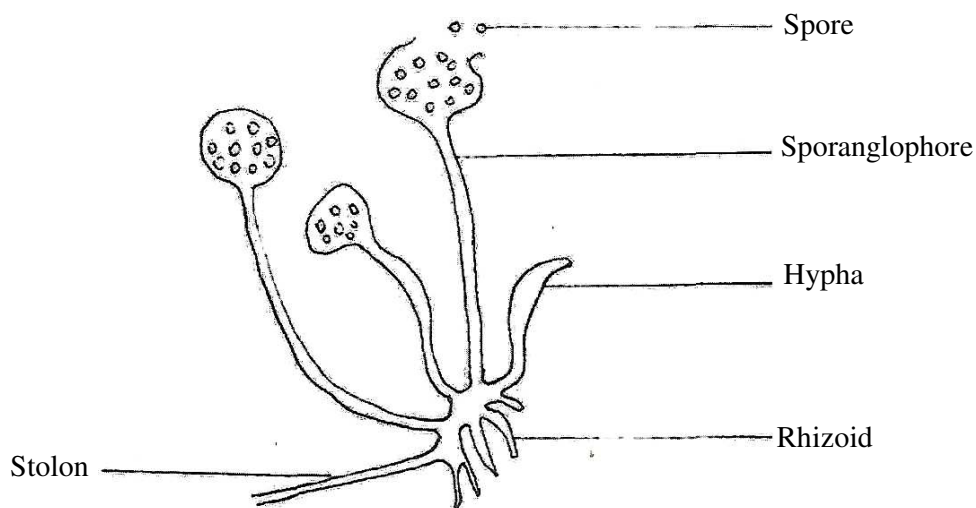
- pith present
- vascular bundles in a ring
- Vascular bundles few
- Cambium present
- Cortex present
- large vascular bundles

PROCEDURE	OBSERVATION	CONCLUSION
Iodine solution /solution J (Added to the food sample drop by drop while shaking)	blue black colour formed	starch present in food sample
benedicts solution/solution K added to the food sample in test tube in equal amounts.	solution changes colour to green, yellow and then orange /brown	more reducing sugar present in food sample

The test tube is then placed in a hot water bath		
burettes reagent /solution L added to the food sample drop by drop while shaking;	colour of reagent retained	protein absent int eh food sample

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PRACTICAL
MARKING SCHEME

1. (a) (i) Epigeal germination;
(ii) Hypocotyle grows faster; raising the cotyledons above the ground level;
(2 mks)
- b) Protection of the embryo/plumule/plumule and radicle;
Food storage;
Photosynthesis;
- c) Emergence of the hypocotyle exposes it to light;
Light stimulates migration of auxins to the lower side of the hypocotyle;
High concentration of auxins; on the lower side;
Stimulates faster rate of growth than on the upper side;
Faster elongation of the lower side straightens the seedlings;
2. a) i) Rhizopus/Bread mould/cassava mould/ugali mould/mould/mucor; *Rhizopus spp*\
- (ii) By spores/sporulation/sporulation; (Hi)



Mg x5 - x 25 Drawing (P)

1. Continuous outline

L = 5 max 2 mks D
= 1 mg = 1

Max = 3 mks

2. Use of double lines

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3. Stolon/Rhizoid not a must

(b) (i) Dicotyledonae;

Net/Reticulate venation/network venation; Floral parts in 5s/fours/five sepals/five petals;
Broad leaf lamina/bract; Presence of leaf paticle;

(1 mk)

Conspicuous bracts/ petals/ sepals/brightly coloured petals/bracts;;

Tabular corolla;

Landing stage/corolla stage/platform;

First correct three (3 mks)

	F(pH5)	G(pH7)	H (pH 9)
Volume of solution + portion of potato	2.2 + 0.2;		
Volume of solution + portion of potato + foam	4.2 ±0.5;		
Volume of foam	2.0 + 0.5;		

Award accuracy for volume of solution + portion of potato

* Values should be F <; G <; H and solution + potato + foam is > solution + potato;
3 mks

Award correct subtraction for volume of foam

3x1 = 3 mks

(b) The enzyme catalase; in the potato tissue breaks down hydrogen peroxide to water; and oxygen; (3 mks)

(c) More foam is produced at pH 9; which is optimum for catalase activity;

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1. (a) (i) Sternum; (1 mk)
- (ii) The internal intercostal muscles relax; pulling the ribs upwards; and outwards;
 This increases the volume of the rib cage while pressure decreases;
 Forcing air into the lungs; (5 mks)
- (b) (i) Anterior/dorsal view; (1 mk)
- (ii) Name - Neural canal; (1 mk)
 Function - Passage of the spinal cord. (1 mk)
- (iii) **V**: It is thick and solid; for bearing the weight of the body (back) (2 mks)
S: It is long; to provide a large surface area for attachment of muscles; (2 mks)
- (c) (i) Image width = 9.8 cm;
- (ii) Magnification = $\frac{\text{Image length / width}}{\text{Actual length / width}}$;
 = $\frac{9.8 \pm 0.1}{4.6 \pm 0.1}$
 Mg = $\times 2.13$;
- (iii) Actual length AB = $\frac{10.4 \pm 0.1}{2.13}$;
 = 4.8826 cm ;

(5 mks)

Food Substance Tested	Procedure	Observation	Conclusion
1. Reducing sugars	<ul style="list-style-type: none"> •Put 2 cm³ of C in a test tube; •Add equal volume of Benedict's Solution. •Put in a hot water bath/heat/ warm/boil; 	No colour change/ blue colour remains/ colour of Benedict's solution remains/ persists;	Reducing sugars absent;
2. Reducing sugar	<ul style="list-style-type: none"> •Put 2 cm³ of C in a test tube: Add a few drops of dilute hydrochloric acid. •Place the test tube in a hot water bath for 3 minutes; •Remove the test tube and cool in cold water. •Add (NaHCO₃), drop by drop until fizzing stops •Add 2 cm³ of Benedict's Solution. 	Colour changes to green / yellow / orange / brown;	Reducing sugars present;

	•Place the test tube in a hoi water bath/heat/warm/boil;		
3. Proteins	•Put 2 cm ³ of C in a test tube: •Add an equal amount of sodium hydroxide solution and shake. Add copper sulphate drop by drop, shaking well after each addition;	Colour changes to purple/violet/mauve;	Proteins present;

3.

1. (a) Simple leaves go to 2;
 (b) Compound leaves go to 4;

2. (a) Leaves net-veined/reticulate go to 3;
 (b) Leaves parallel veined *Commelinaceae*;

3. (a) Leaves with serrated margins *Malvaceae*;
 (b) Leaves with smooth (entire) margins *Nystaginaceae*;

4. (a) Leaves opposite go to 5;
 (b) Leaves alternate *Bignoniceae*;

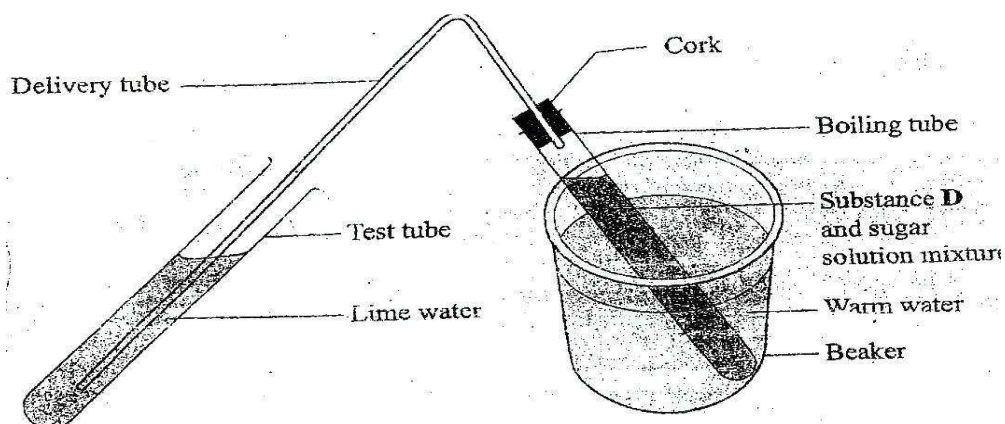
5. (a) Leaves pinnate *Papilionaceae*;
 (b) Leaves trifoliolate *Compositae*;

(10 mks)

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1.a) You are provided with solutions labeled **Q** and **R**, a substance labeled **D** and a delivery tube fitted with a rubber bung/cork.

- i) Label solution **Q** as **lime water**
- ii) Label solution **R** as 10% sugar solution
- iii) Add substance **D** to the 10% sugar solution
- iv) Tightly close/plug the boiling tube with the rubber bung/cork fitted with a delivery tube.
- v) Dip the other end of the delivery tube in the test tube containing lime water.
- vi) Put the boiling tube in the warm water bath at 40⁰C and allow the set up stand as shown in the diagram below.
- vii) Observe the set up for about 15 minutes



- i) State the observations made in the lime water (2 mks)
Bubbles/gas formed/effervescence
Lime water turns white/milky/cloudy/white ppt/white suspension
- ii) Explain the observation made in the lime water. (2 mks)
Gas produced is carbon (iv) oxide/ carbon dioxide/CO₂ which reacts with limewater
Ca(OH)₂ to form a (white ppt/calcium carbonate/ insoluble solid/ compound

2 . You are provided with specimens labeled **E** and **F**

- a) i) name the subdivision to which the specimen belong. (1 mk)

Angiospermophyta/ angiospermatophyta/angiospermine

- (ii) Using observable features on the specimen, given **two** reasons for your answer in (a)(i) above(2 mks)

E- Presence of fruits/ flower/seed structure in fruits

F- Presence of veins in leaves

- b) state the difference between the

- i) leaves of specimens **E** and **F** (5 mks)

LEAF E	LEAF F
Ovate	Lanceolate
Opposite	alternate
Nonsucculent	succulent/fleshy
Serrated/saw like	smooth margin
Rough surface	smooth surface
Green	purple
Thin	thick
Broad	narrow
Has (compact) leaf stalk parallel/veined	

- ii) stems of specimens **E** and **F**

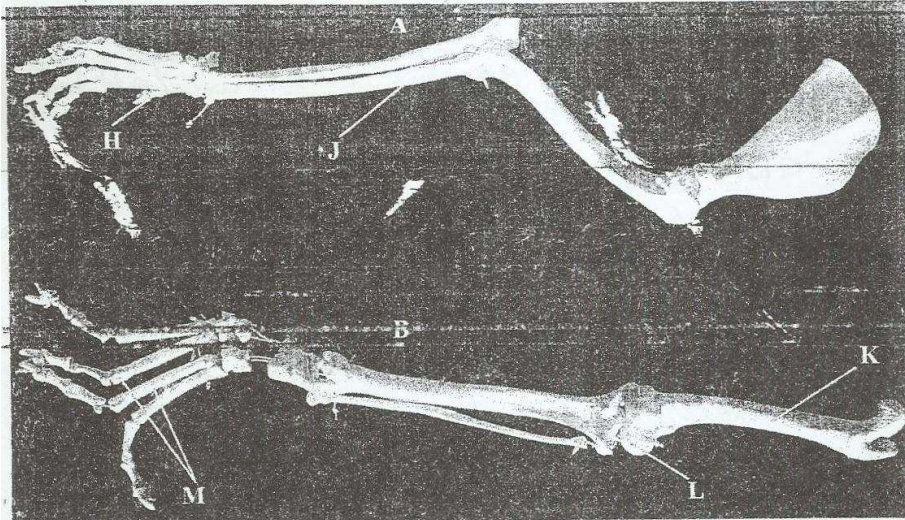
STEM E	STEM F
Leaf opposite	leaf alternate
Angular/cubical/rectangular/square	round/cylindrical/circular/rounded
Prickly/prickly/thorny/spiny/spiky	smooth
Woody/hard	herbaceous/soft
Green/grey	purple

- c) using observable features on the specimen, state the adaptation of the stem of specimen **E** to its habitat.(4 mks)

Prickly/thorny/spiny/prickly for protection against browsers animals/herbivorous

Hard/woody; for (mechanical) support

3. The photograph below shows two (A and B) skeletal limbs of a certain mammal



a) i) Which of the two (A and B) skeletons represents a forelimb? (1 mk)

A

ii) State two features observable on the skeleton to confirm your answer in (a)(i) above

(2 mks)

presence of scapula / shoulder blade

presence of olecranon (process) / ulna / radius / ulna and radius / humerus

b) Name the bones labeled J, K and M

J Radius (1mk)

K Femur (1mk)

M Metatarsal (s) (1mk)

c) Which bone forms the second joint with the bone labeled K? (1mk)

Pelvic (girdle) bone / hip (bone / girdle)

Innominate bone

iii) Name the physiological process that was being investigated (1mk)

Respiration / aerobic respiration / alcohol / fermentation aerobic respiration

iv) Write a word equation for the physiological process investigated (1mk)

Respiration/ aerobic respiration

Glucose (sugar) + oxygen \Rightarrow / carbon (dioxide + water + energy)

v) Why was the warm water bath used in the experiment? (2mks)

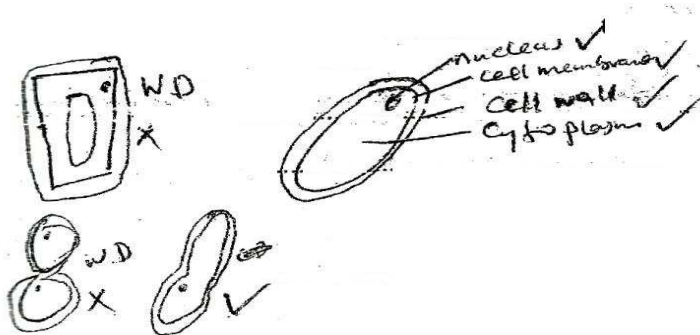
To provide optimum / best / most suitable temperature; for enzyme activity / action / reaction / function

Acc break down

b) Put a drop of the content in the boiling tube on a microscope slide, stain with a drop of methylene blue and cover with a cover slip

Observe it under a light microscope using low, medium and high power objective lenses

i) Draw and label one of the structures observed under the high power objective lens (3mks)



Labeling 4 max

Continuous outline

Not wavy

Nucleus present

Diagram oval / not round

Rj. If compass is used

Many cells are drawn

ii) State the magnification of your drawing

x200 - x 675

eye pieces mg x 3, 4, 5, 7, 10, 15

Objective lenses x 40, 45, 50, 60, 65

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iii) State the identity of substance D (1mk)

Yeast/yeast cell / yeast cells / yeast bud /yeast budding / yeast substance / granite / powder /yeast parent cell / yeast fungus

(d) Name the type of joint formed at the part labelled **H** and **L**.

H- Gliding joint/ sliding joint

(1mk)

L- Hinge joint

(1mk)

(e) Apart from the bones, state the function of any **two** other components of a joint.

(4mks)

COMPONENT	FUNCTION
Ligament	Attach a bone
cartilage	Shock absorber/reduce friction
Synovial fluid	lubrication
Synovial membrane	Secretes synovial fluid/enclose synovial fluid

