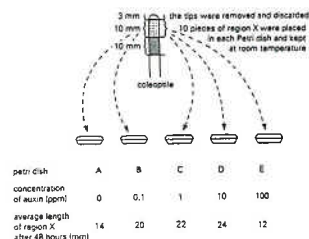


**Past HKCEE Questions**  
**Growth Response of Plant**  
**Paper I**

1. Some oat seeds were germinated and grown in the dark. Three days later, 50 straight coleoptiles were chosen and treated as shown in the diagram below:



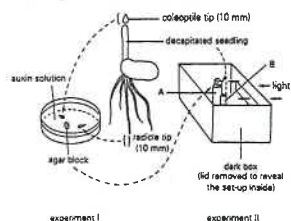
- What is the purpose of
  - removing the tips of the coleoptiles?
  - using 10 coleoptiles in each dish?
- In what concentration of auxin did most growth occur?
- What conclusions can be drawn from the above results?
- State one difference between the cells of the coleoptiles in dishes A and C after 48 hours.
- Why should region X be used instead of region Y?

(HKCEE 1983)

2. The diagram below shows two experiments to study the effect of auxins on the growth of oat seedlings. In experiment I, the tips of radicles and coleoptiles measuring 10 mm were removed and immersed in auxin solutions of different concentrations are left there for two days.

In experiment II, two of these decapitated seedlings, A and B, were then grown inside a dark box illuminated by a unilateral light source. An agar block, previously immersed in an auxin solution of  $10^{-1}$  ppm concentration, was placed on top of seedling A.

(The parts are not drawn to the same scale.)



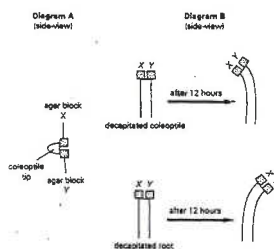
The results of experiment I are shown in the table below:

Concentration of auxin solution (ppm)	Lengths (mm) after two days	
	radicle tips	coleoptile tips
$10^{-6}$	12.3	12.2
$10^{-5}$	13.5	12.2
$10^{-4}$	12.5	12.5
$10^{-3}$	11.1	13.3
$10^{-2}$	10.6	13.9
$10^{-1}$	10.4	15.1
1	10.1	15.7
$10^1$	10.1	14.6
$10^2$	10.1	13.3
$10^3$	10.1	11.3

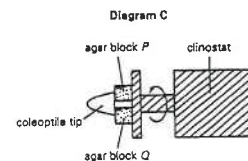
- Using graph paper, draw two curves on the same graph to show the data given in the table.
- Which concentration of auxin solution would exert
  - the greatest inhibitory effect on the radicle?
  - the greatest stimulative effect on the coleoptile?
- Compare the effect of auxin on the radicle and that on the coleoptile at each of the following concentrations:
  - $10^{-5}$  ppm
  - $10^{-3}$  ppm
- With reference to experiment II, state and explain the direction of bending, if any, for seedlings A and B after they have been growing for two days.

(HKCEE 1986)

3. The following experiment was performed in the dark using oat seedlings. A number of coleoptile tips were placed horizontally, and fixed to each tip were two agar blocks, X and Y, as shown in diagram A. After several hours, the agar blocks were transferred to a coleoptile and a root whose tips had been removed as shown in diagram B. The results were observed after 12 hours.



- Explain the result observed on the decapitated coleoptile on a hormonal basis. (3 marks)
- Explain why a different response was shown by the decapitated root. (2 marks)
- In another experiment, a coleoptile tip together with agar blocks P and Q was placed on a rotating clinostat, as shown in diagram C below, for several hours. The agar blocks were then placed on top of a decapitated coleoptile as in the previous experiment. What response would you expect to observe after 12 hours? Explain your answer. (4 marks)



(HKCEE 1988)

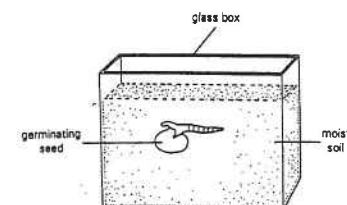
4. An experiment was carried out to investigate factors affecting root growth. A petri dish was held vertically (diagram A), so that its upper half contained plain agar. A mungo bean seedling was then placed in the agar as shown. Observations were made at day 2 and day 5. The results are shown in diagrams B and C. The plain agar provided a moist medium for the growth of the seedling, and the experiment was carried out in the dark.

Experimental set-up	Time of observation
<p>A</p> <p>side view      surface view</p>	Day 0 (Beginning of the experiment)
<p>B</p>	Day 2
<p>C</p>	Day 5

- Name the growth response of the seedling as observed on day 2.
  - Explain this growth response on a hormonal basis. (5 marks)
- Explain the growth response of the seedling as observed on day 5 in terms of the relative effects of the different stimuli acting on it.
  - Explain the significance of this growth response. (4 marks)

(HKCEE 1989)

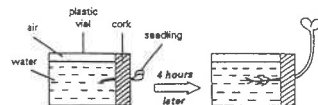
5. The diagram below shows a germinating seed placed horizontally inside a glass box containing moist soil. The radicle of the seed was marked with ink lines at 2 mm intervals. The whole set-up was put in darkness.



- What is the purpose of marking the radicle of the seed with lines at equal intervals? (2 marks)
- Draw a diagram to show the changes in the appearance of the radicle after a few days. (2 marks)
  - Explain the importance of such changes to the plant. (3 marks)
- If this experiment were to be carried out inside a space shuttle flying in space, what would be the appearance of the radicle after a few days? Give a reason for your answer. (2 marks)

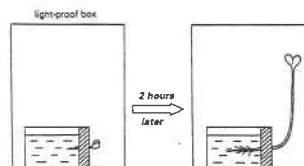
(HKCEE 1990)

6. In a growth response experiment, a bean seedling was inserted into a transparent plastic vial. The whole set-up (A) was held horizontally and placed in a well-illuminated area. It took 4 hours for the seedling to curve upwards as shown below:



Set-up A

Another similar set-up (B) was placed inside a lightproof box. It took 2 hours for the seedling to curve upwards. The seedling, however, is longer and more slender than that grown in light,



Set-up B

- Explain the curvature of the seedling observed in set-up B on a hormonal basis. (4 marks)
  - Suggest a reason why it took a longer time for the seedling in set-up A to curve upwards. (2 marks)
  - What other evidence can be obtained from the experimental results to support your answer in (ii)? (1 mark)
  - Draw a diagram to show how set-up B could be modified to demonstrate the relative effects of gravity and light on the growth response of the seedling. (2 marks)
- (HKCEE 1992)

### Past HKCEE Questions Growth Response of Plant Paper II

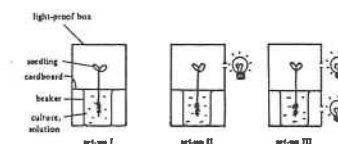
90-46

Which of the following treatments shown below results in the oat coleoptile bending towards the LEFT side?

- Light from the RIGHT side only
- Metal foil; Light from the RIGHT side only
- Metal foil inserted into the RIGHT side; coleoptile in DARKNESS
- Auxin paste applied onto the RIGHT side; coleoptile in DARKNESS

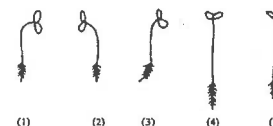
91.

Directions: Questions 40 and 41 refer to the diagram below which shows the experimental set-ups used to study the growth responses of plant seedlings:



91-40

After a few days, the appearance of the plant seedling in the three set-ups would be



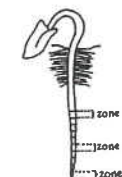
- |    | Set-up I | Set-up II | Set-up III |
|----|----------|-----------|------------|
| A. | (1)      | (2)       | (4)        |
| B. | (2)      | (4)       | (5)        |
| C. | (4)      | (1)       | (3)        |
| D. | (5)      | (3)       | (1)        |

91-41

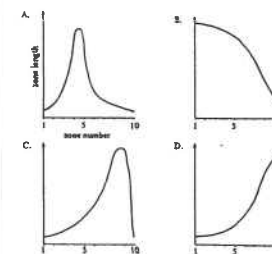
The result of set-up I demonstrates  
A. etiolation.  
B. geotropism.  
C. positive phototropism.  
D. negative phototropism.

92-60

The root tip of a young seedling was marked with Indian ink at equal intervals of 2 mm from the tip as shown below:

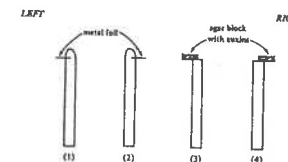


After two days, the length of each zone was measured, and a graph was plotted. Which of the following graphs best represents the growth pattern of the root tip?



93-30

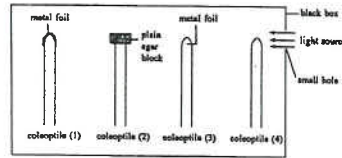
Four coleoptiles, treated as shown below, are placed in the dark



Which coleoptiles will bend towards the right hand side?

- A. (1) and (3)  
B. (1) and (4)  
C. (2) and (3)  
D. (2) and (4)

Directions: Questions 31 and 32 refer to the diagram below which shows an experimental set-up up to study the effect of light on the growth of oat coleoptiles:



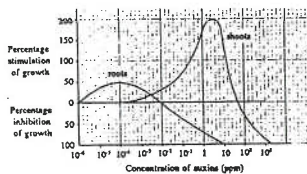
94-31  
Which coleoptiles will bend towards the light source?

- A. Coleoptiles (1) and (2) only  
B. Coleoptiles (3) and (4) only  
C. Coleoptiles (1), (2) and (4) only  
D. Coleoptiles (2), (3) and (4) only

94-32  
If the hole of the black box is covered up, which of the following is correct with regard to the growth of the coleoptiles?

- A. Coleoptile (1) will grow faster.  
B. Coleoptile (4) will stop growing.  
C. Coleoptiles (2) and (3) will show bending.  
D. Coleoptiles (1) and (4) will grow vertically upward.

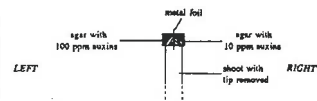
95.  
Directions: Questions 40 and 41 refer to the graph below which shows the effect of auxin concentration on the growth of roots and shoots:



95-40  
What is the effect of auxins at a concentration of  $10^{-3}$  ppm on the growth of roots and shoots?

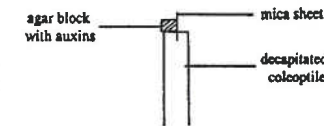
- |    | Growth of roots | Growth of shoots |
|----|-----------------|------------------|
| A. | stimulated      | stimulated       |
| B. | stimulated      | inhibited        |
| C. | inhibited       | stimulated       |
| D. | inhibited       | inhibited        |

95-41  
Predict the growth of the shoot when two pieces of agar with different concentrations of auxins are placed on its tip as shown below:

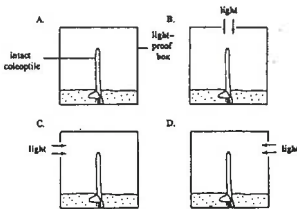


- A. It will grow towards the left.  
B. It will grow towards the right.  
C. It will grow straight upwards.  
D. It will not grow at all.

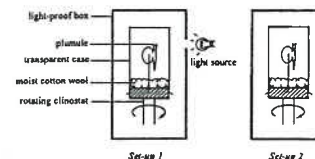
97-36  
In a set-up, the tip of a coleoptile was removed and the coleoptile was treated as shown in the diagram below:



Which of the following set-ups will give a similar result as the one above?



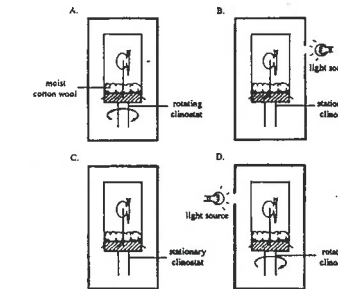
98.  
Directions:  
Questions 38 and 39 refer to the diagram below which shows two clinostats set up by a student. Both clinostats were rotating throughout the investigation.



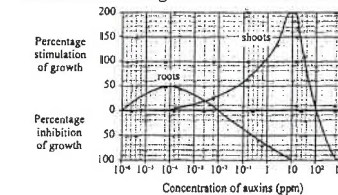
98-38  
What would be the change in the plumule after a period of growth?

- |    | Set-up 1          | Set-up 2         |
|----|-------------------|------------------|
| A. | no bending        | no bending       |
| B. | no bending        | bend to one side |
| C. | bend to the right | no bending       |
| D. | bend to the right | bend to one side |

98-39  
In order to study the phototropic response of the plumule, which of the following set-ups should be used for comparison with set-up 1?

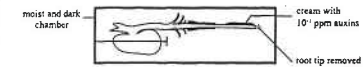


03.  
Directions: Questions 50 and 51 refer to the graph below, which shows the effect of auxin concentration on the growth of roots and shoots



- 03-50  
Which auxin concentration will stimulate growth of both the roots and shoots?
- A.  $10^{-6}$  to  $10^{-2}$  ppm  
B.  $10^{-4}$  to  $10^{-2}$  ppm  
C.  $10^{-4}$  to  $10^0$  ppm  
D.  $10^{-6}$  to  $10^2$  ppm

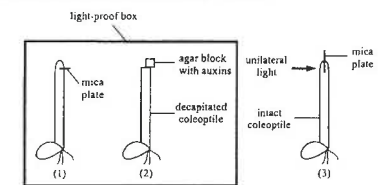
03-51  
A bean seedling, with its root tip removed, was pinned in a moist and dark chamber. A paste of cream containing  $10^{-1}$  ppm auxins was smeared on one side of the root as shown in the diagram below:



After two days, the root was found to bend upwards. Which of the following is responsible for this change?

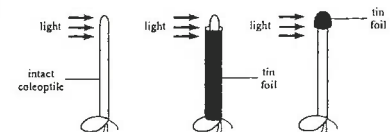
A. Cells in the region of elongation grew faster.  
B. The root showed negative geotropic response.  
C. The effects of hydrotropism and phototropism were cancelled.  
D. The upper side of the root received a higher auxin concentration than the lower side.

05-39  
Which of the following oat coleoptiles will bend toward the left hand side during growth?



- A. (1) only  
B. (2) only  
C. (1) and (3) only  
D. (2) and (3) only

05-58  
The diagram below shows an experiment used to study the growth of oat coleoptile:



What is the hypothesis being tested in this experiment?

A. The coleoptile is positively phototropic.  
B. The tip of the coleoptile is sensitive to light.  
C. Auxins are produced by the tip of the coleoptile.  
D. Growth occurs mainly in the region of elongation.

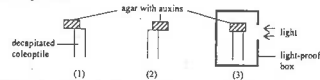
06-46  
If a mung bean seed is germinated and grown on an agar plate with high concentration of auxins, which of the following may be observed?

A. The shoot and root grow at the same rate.  
B. Both the growth of shoot and root are promoted.

- C. The growth of shoot is promoted while that of root is inhibited.
- D. The growth of shoot is inhibited while that of root is promoted.

06-47

The following diagram shows an experiment to investigate the growth response of decapitated coleoptiles:

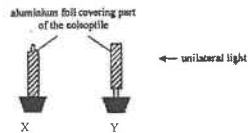


Which of the following correctly states the growth direction of the three decapitated coleoptiles?

- |          |       |       |
|----------|-------|-------|
| (1)      | (2)   | (3)   |
| A. left  | right | right |
| B. right | left  | left  |
| C. left  | right | left  |
| D. right | left  | right |

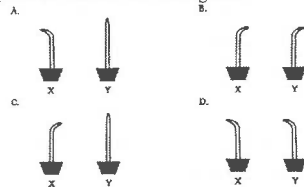
07

Directions: Questions 59 and 60 refer to the diagram below, which shows a set-up designed by a student for investigating the growth response of coleoptiles:



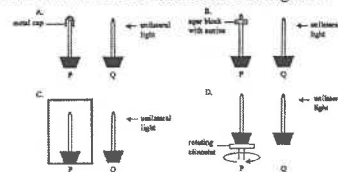
07-59

After a few days, the aluminium foil was removed. Which of the following diagrams shows the most probable results of the investigation?



07-60

Which of the following set-ups would probably serve a similar aim as the student's investigation?



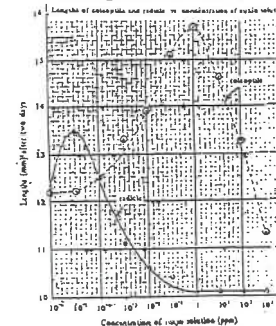
# Past HKCEE Questions Growth Response of Plant Suggested Answers

## Paper I

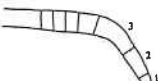
1. (i) (1) get rid of cells producing auxin so that the conc. of auxin solution in the dish would not be affected. 1
- (2) to obtain a more reliable / accurate result 1
- (ii) 10 ppm (NOT D) 1
- (iii) growth increases as conc. of auxin increases / auxin stimulates growth up to a maximum effect at 10 ppm / optimum concentration 1
- any further increase concentration higher than 10 ppm would diminish growth 1
- (iv) 1

Cells in	A (0 ppm)	C (1.0 ppm)
Elongation	Shorter	Longer

- (v) X elongates more / is the region of elongation / is region of most active growth giving a more obvious results (or vice versa) 1
2. (i) using correct axes as shown plotting 8 correct points for 1 curve plotting 8 correct points for the other curve joining points together on each curve labelling one or both curves 1

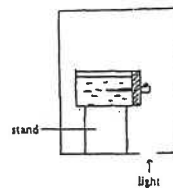


- (ii) (1)  $1 / 10^1 / 10^2 / 10^3$  / ppm (any concentration within this range) 1
- (2) 1 ppm 1
- (iii) (1) resulting in equal elongation in coleoptile and radicle (as auxin concentration increases beyond  $10^{-4}$  ppm, coleoptile elongates more while radicle elongates less) 1
- (2) resulting in different elongations in coleoptile and radicle / less inhibitory on coleoptile / coleoptile elongates more (inhibitory effect on both) 1
- (iv) A - bends towards the light source auxin on agar block diffused down the coleoptile auxin was redistributed or inhibited by light / more auxin on the shaded side resulting in greater elongation on the shaded side 1
- B - no bending no auxin supply 1
3. (i) in the coleoptile tip of diagram A, auxins moved downwards as a result of gravity more auxins diffused into Y than into X more growth occurred on the side of the decapitated coleoptile below Y [OR vice versa] 1
- (ii) greater concentration of auxins in the root may retard growth hence, less growth occurred under Y [OR vice versa] 1
- (iii) the decapitated coleoptile would grow vertically / with no bending [accept diagrams conveying the same meaning] the effect of gravity on auxin distribution was cancelled out by the rotation of the clinostat resulting in equal distribution of auxins in P and Q 1
4. (i) (1) \* geotropism / geotropic response 1
- (2) the force of gravity results in a higher concentration of auxin / hormone on the lower side of the root 1

- since a high concentration of auxin / hormone retards growth of the root  
upper part of the root grows faster / lower side of the root grows slower
- (ii) (1) the root bends upwards / towards the source of water instead of downwards  
(2) root grows towards sources of water to ensure enough supply of water for growth
5. (i) to compare growth at different regions of the radicle  
e.g. to find out which region of the radicle grows faster  
(ii) (1) 
- growth in length mainly takes place in the region of elongation (starting from region 2 or region 3)  
radicle bends downwards  
(2) enable the roots to grow deeper into the soil for better anchorage  
to ensure the root to absorb enough water (dissolved mineral salts) / to reach a new source of water (dissolved mineral salts)
- (iii) the radicle grows in length but does not bend  
(N.B. diagram acceptable)  
because no gravity acting on it
6. (i) Due to the effect of gravity there is a higher concentration of auxin accumulated on the lower side of the horizontally placed seedling  
auxin has a growth stimulatory effect  
therefore the lower side grows faster than the upper side and the seedling curves upwards  
(ii) Auxin moves away from light / light destroys or inactivates auxins resulting in an overall lower auxin concentration in seedling A  
therefore it grows more slowly because of the less stimulatory effect

- (iii) The shorter seedling in A  
(iv) apply a unilateral light source from the bottom as shown below:

2  
or  
0



N.B. No light, no mark

#### Paper II

90-46	D
91-40	C
91-41	A
92-60	A
93-30	C
94-31	B
94-32	D
95-40	A
95-41	A
97-36	D
98-38	A
98-39	B
03-50	B
03-51	D
05-39	B
05-58	B
06-46	C
06-47	Deleted
07-59	C
07-60	A