

# Indian National Biology Olympiad (INBO) -2024

Homi Bhabha Centre for Science Education (HBCSE-TIFR)

## Answer Booklet

Time: 2 hrs

ROLL NO.  –  –

Max. Marks: 300

- Please write your roll number on the top of **every page of this answer booklet** in the space provided.
- Before starting, please ensure that you have received a copy of the answer booklet containing a total of 14 numbered sheets.
- **This answer booklet must be returned to the invigilator.**

Signature of Student: \_\_\_\_\_

Signature of Invigilator: \_\_\_\_\_

Date:

Place:

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*(Do not write anything below this line.)*

	X	Y	Not attempted	
Section A				3X - Y =
Section B				3X =
<b>Total score =</b>				

**INBO – 2024**

**ROLL NO.**  –  –

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## SECTION A

Q. No.	a	b	c	d	Q. No.	a	b	c	d	Q. No.	a	b	c	d
1.			✓		13.			✓		25.			✓	
2.	✓				14.			✓		26.		✓		
3.			✓		15.			✓		27.			✓	
4.		✓			16.			✓		28.		✓		
5.			✓		17.				✓	29.	✓			
6.				✓	18.				✓	30.		✓		
7.				✓	19.				✓	31.		✓		
8.				✓	20.		✓			32.			✓	
9.			✓		21.				✓	33.	✓			
10.	✓				22.			✓		34.		✓		
11.	✓				23.				✓					
12.		✓			24.		✓							

	X	Y	Not attempted	
Section A				3X - Y =

**SECTION B****CELL BIOLOGY (14.5 Points)**

35. (2 points)

	a.	b.	c.	d.
True	✓		✓	✓
False		✓		

36. (2 points)

	a.	b.	c.	d.
True			✓	
False	✓	✓		✓

37. (2 points)

	Gene A		Gene B	
	Will Express	Will not express	Will Express	Will not express
I.	✓		✓	
II.	✓		✓	
III.		✓	✓	
IV.	✓			✓

38. (5 points)

(A)

NF- $\kappa$ B responsive genes	X
I $\kappa$ B- $\alpha$ gene	Y

(B)

p65	B
I $\kappa$ B- $\alpha$	C
$\alpha$ -actin	D
Lamin	A

(C)

No.	Effector in the presence of TNF	TNF dependent NF- $\kappa$ B induced gene expression	
		Induced	Inhibited
1.	Inhibitor of kinase activity		✓
2.	Activator of phosphatase activity		✓
3.	Activator of ubiquitin dependent proteasome activity	✓	
4.	Inhibitor of nuclear transport activity		✓

39. (1.5 points)

	a.	b.	c.
True	✓		✓
False		✓	

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40. (2 points)

Answer: \_\_\_\_\_ 79 \_\_\_\_\_ molecules (tetrameric)

Calculations:

**PLANT SCIENCES (13 points)**

41. (2 points)

Conditions	a.	b.	c.	d.
Increased water use efficiency	✓			
Decreased water use efficiency		✓	✓	✓

42. (2.5 points)

Sr. No.	Structural / biochemical trait	Sun-loving	Shade-loving
1	Dry mass per area	H	L
2	Spongy parenchyma thickness	S	S
3	Density of stomata	H	L
4	Chlorophyll per dry mass	L	H
5	Chl-a to Chl-b ratio	H	L

43. (2 points)

	a.	b.	c.	d.
True	✓			✓
False		✓	✓	

44. (3 points)

		Plant 1		Plant 2	
		Side facing the sun	Side not facing sun	Downward / side facing the ground	Upward / side facing sky
(i)	Movement of auxin towards		✓	✓	
(ii)	Rapid cell growth		✓	✓	
(iii)	Bending towards	✓			✓

45. (2 points)

Answer: \_\_\_\_ 3.75 MPa \_\_\_\_

Calculations:

46. (1.5 points)

	a.	b.	c.
True	✓	✓	
False			✓

**ANIMAL SCIENCES (12 points)**

47. (2 points)

a.	b.	c.	d.
✓			

48. (3.5 points)  
(A)

P: \_\_\_\_\_ a \_\_\_\_\_

Q: \_\_\_\_\_ b \_\_\_\_\_

R: \_\_\_\_\_ b \_\_\_\_\_



(B)

	a.	b.	c.	d.
Correct	✓	✓		
Incorrect			✓	✓

49. (2.5 points)

I: \_\_\_ii, v\_\_\_

II: \_\_\_vii\_\_\_

III: \_\_\_iv\_\_\_

IV: \_\_\_i, vi\_\_\_

V: \_\_\_iii\_\_\_

50. (2 points)

i) Umbilical vein  Inferior vena cava  Superior vena cava

ii) Pulmonary vein  Pulmonary trunk  Inferior vena cava

51. (2 points)

Physiologic functions	Sympathetic	Parasympathetic
Cardiovascular	b	a
Pulmonary	a	b
Pupillary	a	b
Musculoskeletal	b	a

**GENETICS & EVOLUTION (12.5 points)**

52. (2 points)

	a.	b.	c.	d.
True		✓	✓	
False	✓			✓

53. (2 points)

Answer: \_\_\_\_\_ 43.15 \_\_\_\_\_ %

Calculations:

54. (2 points)

	a.	b.	c.	d.
True			✓	✓
False	✓	✓		

55. (3 points)

(A) Answer: \_\_\_\_\_ No \_\_\_\_\_

(B) Answer: A = 0.5000; B = 0.325; C = 0.175

Calculations:

56. (1.5 points)

Mutant 1: II

Mutant 2: II

Mutant 3: III

57. (2 points)

Individual II – 1: I<sup>A</sup>I<sup>A</sup> or I<sup>A</sup>i or hh

Individual III– 1: i/i, H/h

**ECOLOGY** (5 points)

58. (2 points)

A > C > B > D

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59. (3 points)

(A) Answer: \_\_\_\_ 1998 \_\_\_\_

(B) Answer: \_\_\_\_ 2015 - 16 \_\_\_\_

**ETHOLOGY** (7 points)

60. (2 points)

	a.	b.	c.	d.
True		✓	✓	✓
False	✓			

61. (2.5 points)

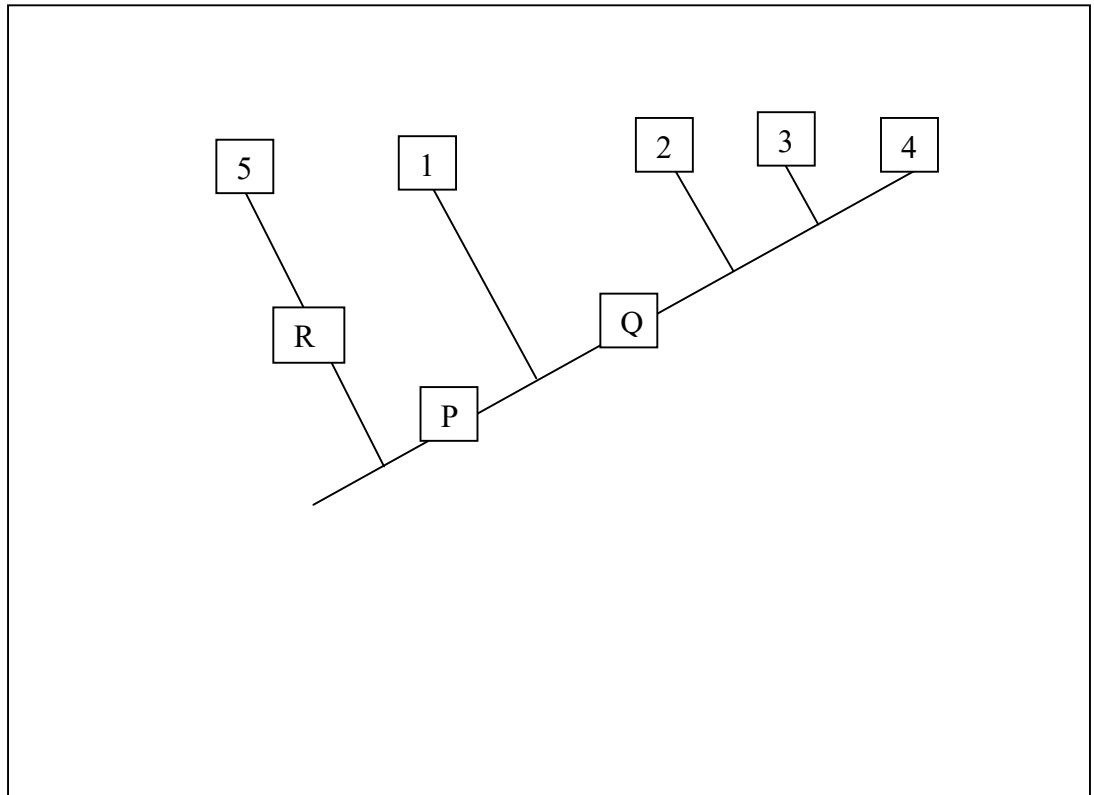
	a.	b.	c.	d.	e.
True					✓
False	✓	✓	✓	✓	

62. (2.5 points)

Altered Selection Pressure	Behavioral adaptation/s
(i)	B, D
(ii)	E, F
(iii)	H
(iv)	I
(v)	A, C, G

**BIOSYSTEMATICS (2 points)**

63. (2 points)



\*\*\*\*\*END OF SECTION B \*\*\*\*\*

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**ROUGH WORK**