

TM Jm

Country: _____

Student Code: _____

23rd INTERNATIONAL BIOLOGY OLYMPIAD

8th – 15th July, 2012

SINGAPORE



ANSWER
KEY
r
Marking
scheme

THEORETICAL TEST – PAPER 2

ANSWER SHEET

Theoretical Test Paper 2

Answer Sheet

1. (3.2 points)
- 0.2×16

	Types of organism			
Sample	a	b	c	d
1	X	X	X	X
2	✓	X	X	✓
3	✓	✓	✓	✓
4	X	✓	✓	X

2. (1 point)
- 0.25×4

a	b	c	d
✓	✓	X	X

3. (0.4 point)
- ~~0.25~~
- All-or-none - both must be correct.

Bacterium B is likely to be Gram negative.Bacterium A is likely to be Gram positive.

4. (2.4 points)

4.1. (1.4 points)

$$0.2 \times 7$$

-35	-34	-33	-32	-31	-30	-29
T	A	T	A	A	A	A

4.2. (1 point)

$$0.2 \times 5$$

Sequence element				
Operator	Promoter	Origin of replication (ORI)	Telomere	Enhancer
✓	✓	X	X	✓

5. (2.8 points)

$$0.4 \text{ per cell} \times 7$$

I	II	III	IV	V	VI	VII
b, c	a	c, e	b, d, e	a	b	e, d

6. (0.8 point)

$$0.2 \times 4$$

a	b	c	d
X	X	✓	X

7. (1.5 points)

$$0.3 \times 5$$

I	II	III	IV	V
c	b	a	e	d

8. (1.8 points)

 $0.9 \times \text{per row} \times 2$ (all or none per row)

Cell cycle	Group		
	A	B	C
a. S phase	X	✓	X
b. Longest phase	✓	X	X

} $\rightarrow 0.9$ } $\rightarrow 0.9$

9. (1.6 points)

9.1. (0.8 point)

 0.2×4

a	b	c	d
✓	X	X	X

9.2. (0.8 point)

 0.2×4

a	b	c	d
✓	✓	X	✓

10. (1.2 points)

 0.3×4

Gibberellin	DELLA mutant	GRAS mutant
Present	X	✓
Absent	X	✓

11. (2.4 points)

 $0.4 \text{ pt per column} \times 6$

	I	II	III	IV	V	VI
Ligase	4	3	6	5	1	2
Reaction	B	E	A	F	D	C

$\underbrace{\hspace{1cm}}_{0.4}$
 $\underbrace{\hspace{1cm}}_{0.4}$
 $\underbrace{\hspace{1cm}}_{0.4}$
 $\underbrace{\hspace{1cm}}_{0.4}$
 $\underbrace{\hspace{1cm}}_{0.4}$
 $\underbrace{\hspace{1cm}}_{0.4}$

12. (1.2 points)

0.3 x 4

1	2	3	4
↑	=	=	↑

13. (1.2 points)

0.3 x 4

I	II	III	IV
a	a	d	d

14. (2 points)

0.2 mark per row x10

Organ / Cell	Type of cell division	Ploidy of cells
Endosperm of angiosperm	I	3n
Pollen grain	II	n
Central cells	I	n+n
Egg of angiosperm	II	n
Spore of moss	I	n
Protonema	I	n
Sperm of moss	I	n
Fern gametophyte	I	n
Spore of fern	II	n
Egg of fern	I	n

→ 0.2

→ 0.2

15. (1.8 points)

0.6 x 3

a	b	c
✓	✓	X

16. (2.4 points)

0.3 x 8

Nutrient	Required as trace element	Absorbed by passive transport
NO_3^-	X	X
K^+	X	✓
Mg^{2+}	X	X
Fe^{3+}	✓	✓

17. (1 point)

0.2 x 5

a	b	c	d	e
✓	X	✓	X	X

18. (2 points)

0.4 x 5

Condition	Curve
In actively working muscles	3
In the lung	2
In human fetus	1
With increased temperature	3
With increased CO_2 content	3

19. (1 point)

all-or-none - all must be correct

a	b	c	d	e
X	✓	X	X	X

20. (2 points) 0.4×5

a	b	c	d	e
✓	✓	✗	✗	✓

21. (1.6 points) 0.4×4

a	b	c	d
✓	✓	✓	✗

22. (1.5 points) 0.5×3

a	b	c
✓	✗	✓

23. (0.6 point) *all for now — all must be correct*

Grey matter	White matter
B	A

24. (1.2 points) 0.2×6

a	b	c	d	e	f
✗	✓	✗	✓	✓	✗

25. (1.5 points) 0.5×3

I	II	III
c	b	a

26. (1 point)

Answer: C

27. (4.5 points)

27.1. (3.6 points)

0.4×9

Q ₁₀ value	(i)	(ii)	(iii)
A	2.3	2.4	2.5
B	0.9	2.9	3.3
C	5.0	3.3	6.0

27.2. (0.9 point)

0.3×3

Ectotherm	Endotherm
A, C	B

28. (3.6 points)

28.1. (1 point)

0.5×2

Juvenile	Adult
C	B

28.2. (1 point)

— all - or - none - all must be correct

Juvenile	Adult
A	B

28.3. (1.6 points)

0.4×4

a	b	c	d
X	✓	✓	X

29. (2.2 points)

29.1. (1.2 points)

0.1 X 12

Animal	Cleavage pattern and blastulas	Type of coelom formation
Mouse	2	D
Snail	4	P
Toad	3	D
Chicken	5	D
Seastar	1	D
Fruit fly	6	P

29.2. (1 point)

The main factor is

C

30. (0.8 point)

0.2 X 4

a	b	c	d
X	✓	X	✓

31. (2 points)

0.4 X 5

a	b	c	d	e
X	X	X	X	✓

32. (1 point) 0.2×5

a	b	c	d	e
✓	✓	X	✓	X

33. (2 points)

Answer: $\frac{5}{8}$ (or in % or in equivalent decimal pts.)

34. (1.8 points) 0.3×6

	Lethal	Hairless	Normal
Hairless (Hh) X Hairless (Hh)	2	4	2
Hairless (Hh) X normal (hh)	0	4	4

35. (1+ 2 +1 points = 4 points)

Frequency of disease causing allele (%)	6.09	1
χ^2 (3 decimal places)	0.338	2
Hardy-Weinberg Equilibrium	✓	1

36. (4 points)

36.1. (2 points) 0.5×4

A	B	C	D
✓	X	X	✓

36.2. (2 points)

The probability is 0.

37. (2.7 points)

37.1. (1.5 points)

 0.3×5

Metabolites	Order in the pathway
Citrulline	4
Glutamic semialdehyde	2
Arginine	5
Ornithine	3
Glutamic acid	1

37.2. (1.2 points)

 0.3×4

Step in metabolic pathway	1 → 2	2 → 3	3 → 4	4 → 5
Strain (carrying defect in this step)	B	C	A	D

38. (2 points)

38.1. (1 point)

Answer:

 $\frac{1}{6}$ (or equivalent %)

38.2. (1 point)

Answer:

 $\frac{2}{9}$ (or equivalent %)

39. (1 point)

— all or none (all must be correct)

a	b	c	d	e
X	✓	X	X	X

40. (1 point) - all or none - (all must be correct)

I	II	III	IV	V
✓	✓	✓	✗	✓

41. (1.4 points)

41.1. (0.8 points) 0.2 x 4

a	b	c	d
✓	✗	✓	✗

41.2. (0.6 points) 0.2 x 3

a	b	c
✓	✗	✗

42. (5.1 points)

42.1. (2.4 points) 0.6 x 4

I	II	III	IV
b	a	d	c

42.2. (1.2 points) 0.4 x 3

Island	Pico	Santa Maria	Terceira
Number of endemic species	48-52	100-104	63-68

42.3. (1.5 points)

0.3 x 5

a	b	c	d	e
✓	X	✓	✓	X

43. (1.2 points)

0.2 x 6

I	II	III	IV	V	VI
✓	✓	X	✓	✓	X

44. (1 point)

0.2 x 5

a	b	c	d	e
X	X	X	✓	X

45. (2.4 points)

0.4 x 6

a	b	c	d	e	f
✓	✓	X	✓	✓	X

46. (4.8 points)

46.1. (1.2 points)

0.4 x 3

Taxonomic group	Y	X+Y	W+Z
Morphological character(s)	6	2	1

46.2. (1.2 points)

0.3 x 4

Chelicerata	Crustacea	Hexapoda	Myriapoda
Z	X	W	Y

46.3. (1.2 points)

0.2 x 6

1	2	3	4	5	6
III	IV	VI	V	II	I

46.4. (1.2 points)

0.3 x 4

Monophyletic	Paraphyletic	Polyphyletic
I, IV	II, III	

END OF PAPER