Theoretical Test Paper 1

Answer Key

1. (1.8 points)

a	b	c	d	e	f
✓	✓	✓	×	✓	×

2. (1.8 points)

Cell	Mitochondria present	Functions (a – d) if present
Sperm cell		
Brown fat cell		
Red muscle fibers		
Intestine epithelia		

3. (0.9 points)

Lowest Tm	Medium Tm	Highest Tm
a	c	b

4. (2 points)

Condition	I	II	III	IV
Cell fate	a	b	b	a

5. (4.2 points)

5.1. (3.6 points)

Heptapeptide	pH 1 net charge	pH 7 net charge	pH 12 net charge
Peptide A Asp-Ala-Glu-Asp-Gly-Ser-Ser	+1	-3	-4
Peptide B Gly-Lys-Asp-Ala-Ala-Ser-Gly	+2	0	-2
Peptide C Ser-Lys-Ser-Lys-Gly-Asp-Ala	+3	+1	-2

5.2. (0.6 points)

pH 1	pH 7	pH 12
×	✓	×

6. (0.5 points)

a	b	c	d	e
×	✓	×	×	×

7. (0.9 points)

7.1. (0.4 points)

a	b	c	d
×	×	×	×

7.2. (0.5 points)

The number is 92.

8. (1.8 points)

8.1. (0.6 points)

Bacterium A	Bacterium B	Bacterium C
×	✓	×

8.2. (0.6 points)

C > B > A

8.3. (0.6 points)

a	b	c
✓	×	×

9. (1 point)

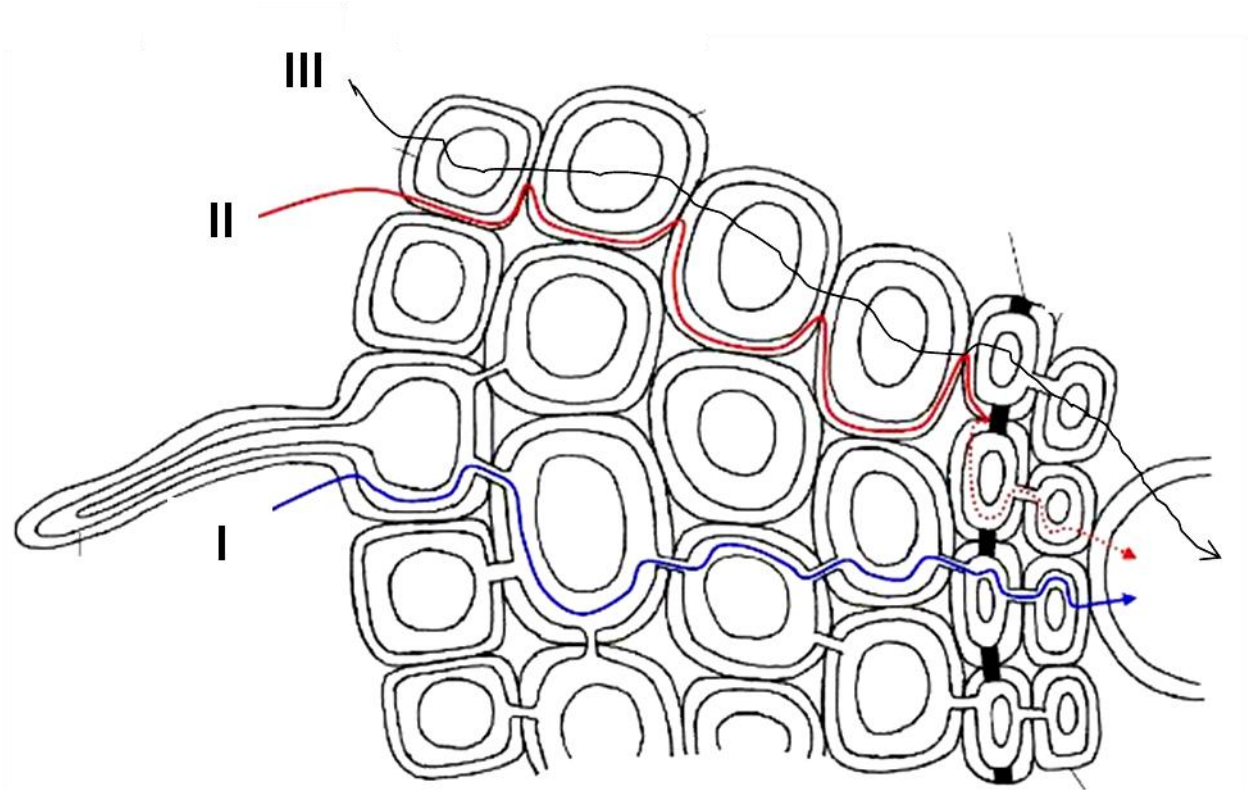
i	ii	iii	iv	v
×	×	✓	✓	✓

10. (4.6 points)

10.1. (1.6 points)

A	B	C	D	E	F	G	H
6	4	9	12	11	17	14	8

10.2. (3 points)



11. (3 points)

1	2	3	4	5	6	7	8	9	10
G	H	B	A	C	I	D	J	F	E

12. (1.4 points)

a	b	c	d	e	f	g
×	×	×	✓	×	✓	✓

13. (1.2 points)

a	b	c
✓	×	✓

14. (1.0 points)

a	b	c	d	e
✓	×	×	×	✓

15. (1.5 points)

Most primitive	Intermediate	Most modern
B	C	A

16. (1.8 points)

1	2	3	4	5	6	7	8	9
E	A	B	H	G	I	C	J	D

17. (1.5 points)

III ⇒ IV ⇒ II ⇒ V ⇒ VII

18. (1.6 points)

18.1. (0.8 points)

A > C > B > D

18.2. (0.8 points)

D > B > C > A

19. (1.6 point)

Animal	Amphibians	Reptiles	Birds	Mammals
I	×	×	✓	✓
II	×	×	✓	×

20. (2.6 points)

Animal	Frog	Salmon	Crayfish	Lizard	Earthworm	Dragonfly
Circulatory system	×	×	✓	×	×	✓
Respiratory organ	a, c	b	b	a	c	d

21. (2 points)

a	b	c	d	e	f	g	h	i	j
✓	✓	×	×	✓	×	×	✓	✓	×

22. (0.8 point)

Saliva secreted/day (litres)	< 0.75	0.75 – 1.5	10 – 12	130 – 180
Animal	a	b	c	d

23. (0.8 point)

	Allergy	Pseudoallergy
a	✓	×
b	✓	×
c	✓	✓
d	✓	×

24. (0.6 points)

a	b	c
✓	×	×

25. (1.2 points)

A	B	C	D
I	II	III	IV

26. (2.4 points)

26.1. (1.2 points)

I	II	III	IV
d	a	b	c

26.2. (1.2 points)

GI tract surface area/ body surface area ratio			
0.6:1	1.2:1	2:1	3:1
a	b	c	d

27. (0.9 points)

I	II	III
c	a	b

28. (2.4 points)

Part of water column / Habitats					Swimming speed	
Surface	Middle	Bottom	Sea grass beds	Rock crevices	Fast	Slow
F	D, H	A, C, E	G	B	D, H	A, G

29. (3 points)

29.1. (1 point)

L/D < 1	b
θ > 45°	b

29.2. (2 points)

a	b	c	d	e
✓	×	×	✓	✓

30. (2 points)

30.1. (1 point)

The minimum number of enzymes needed to produce α-MSH = 3.

30.2. (1 point)

The minimum number of enzymes needed to produce β-MSH = 3.

31. (1.5 points)

a	b	c	d	e
✓	×	×	×	✓

32. (1.2 points)

a	b	c	d	e	g
×	×	×	✓	×	✓

33. (1.2 points)

a	b	c	d
×	×	×	✓

34. (4.8 points)

34.1. The expected ratio = _____ 9:3:3:1 (1 point)

Phenotype	Observed	Expected
Purple flowers, long pollen grains	296	
Purple flowers, round pollen grains	19	
Red flowers, long pollen grains	27	
Red flowers, round pollen grains	85	
Total number of progenies	427	

(1 points)

χ^2 value = _____ (2 points)

34.2. (0.8 points)

Complimentary epistasis	Dominant epitasis	Linkage	Maternal inheritance
×	×	✓	×

35. (2.3 points)

35.1. (1.5 points)

	homozygous	heterozygous	wild type
%	25	50	25

35.2. (0.8 points)

a	b	c	d
×	×	✓	×

36. (1.1 point)

36.1. (0.6 points)

	Homozygous dominant	Heterozygous	Homozygous recessive
Normal	×	×	✓
Creepers	×	✓	×

36.2. (0.5 points)

Normal	Short wings	Short legs	Short wings and legs	Lethal
×	×	×	×	✓

37. (2 points)

37.1. (1 point)

The fraction expected is = 2/3.

37.2. (1 point)

The fraction expected is = 1/12.

38. (3 points)

38.1. (2 points)

The estimated enzyme activity of X (R271Q/E290K) is ≈ 16.5 (any value between 15 to 17).

The estimated enzyme activity of Y (Y424C/ R158Q) is ≈ 30 (any value between 28 to 32).

38.2. (1 point)

The critical range is somewhere between 10 % to 25 % of normal activity.

39. (2 points)

	Cross	Progeny ratio (purple to green)				
		3:1	9:7	15:1	1:7	1:1
i.	ChsA chsA ChsJ chsJ C1C1 **X** ChsA chsA ChsJ chsJ C1C1	×	✓	×	×	×
ii.	ChsA chsA ChsJ chsJ C1c1 **X** chsA chsA chsJ chsJ c1c1	×	×	×	✓	×

40. (0.6 point)

a	b	c
×	×	✓

41. (2.7 points)

41.1. (1.8 points)

Vombatus	Tyr	Asp	Arg
Notoryctes	Leu	STOP	Pro

41.2. (0.9 points)

a	b	c
×	-	✓

42. (3 points)

42.1. (2 points)

a	b	c	d	e
×	×	✓	✓	-

42.2. (1 point)

Line	Taxon
○·····	EM

43. (1.8 points)

a	b	c	d	e	f
✓	✓	×	×	✓	-

44. (1.2 points)

a	b	c	d	e	f
✓	×	✓	✓	✓	×

45. (1.8 points)

a	b	c	d	e	f	g	h	i
✓	×	✓	✓	✓	✓	✓	✓	✓

46. (2.8 points)

a	b	c	d	e	f	g
×	✓	✓	×	✓	✓	✓

47. (1.2 points)

I	II	III	IV	V	VI
e	f	c	b	d	a

48. (1.2 points)

Type of plastids	Taxa
Two-membrane rhodoplast	d
Two-membrane chloroplast	a
Four-membrane rhodoplast	c
Three-membrane chloroplast	b

49. (2.6 points)

49.1. (0.2 points)

Answer: ___A1____.

49.2. (0.2 points)

Answer: ____f_____.

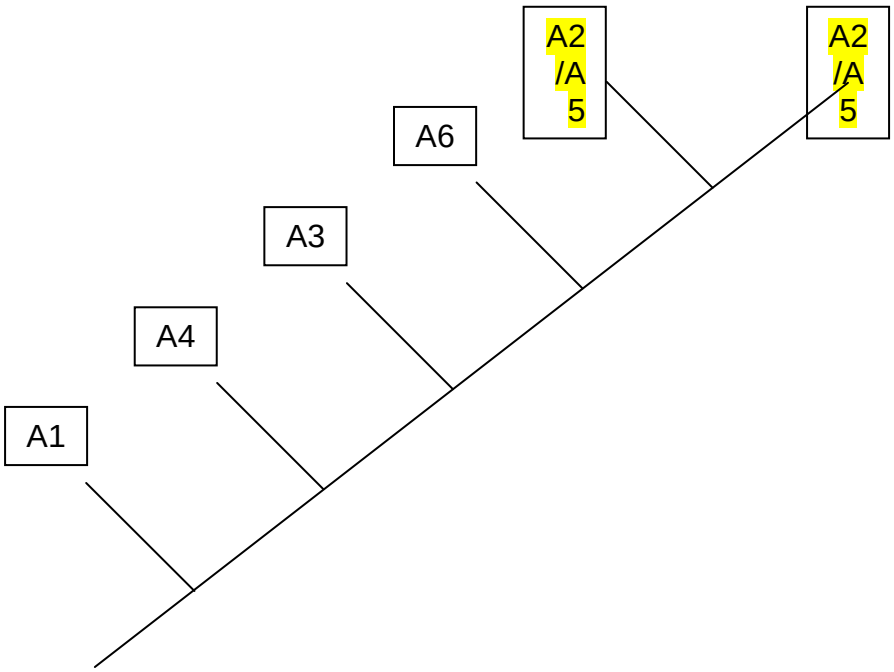
49.3. (0.2 points)

Answer: ____e_ ___.

49.4. (0.2 points)

Answer: ____b_____.

49.5. (1.8 points)



END OF PAPER

Theoretical Test Paper 2

Answer Key

1. (3.2 points)

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

2. (1 point)

a	b	c	d
✓	✓	✓	×

3. (0.4 points)

Bacterium _____ is likely to be Gram negative.

Bacterium _____ is likely to be Gram positive.

4. (2.4 points)

4.1. (1.45 points)

	-35	-34	-33	-32	-31	-30	-29	
5’	T	A	T	A	A/T	A	A/T	3’

4.2. (1 point)

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

5. (2.8 points, 0.4 point per cell)

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

6. (0.8 point)

a	b	c	d
×	×	✓	×

7. (1.5 points)

I	II	III	IV	V
c	b	a	e	d

8. (1.8 points)

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

9. (1.6 points)

9.1. (0.8 points)

a	b	c	d
✓	×	×	×

9.2. (0.8 points)

a	b	c	d
✓	✓	×	✓

10. (1.2 points)

Gibberellin	DELLA mutant	GRAS mutant
Present	×	✓
Absent	×	✓

11. (6 x 0.4= 2.4 points) (0.4pts per column)

	I	II	III	IV	V	VI
Ligase	d	c	f	e	a	b
Reaction	B	E	A	F	D	C

12. (1.2 points)

1	2	3	4
↑	=	=	↑

13. (1.2 points)

I	II	III	IV
a	a	d	d

14. (2 points) (10 x 0.2, mark by row)

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	II	n
Protonema	I	n
Sperm of moss	I	n
Fern gametophyte	I	n
Spore of fern	II	n
Egg of fern	I	n

15. (1.8 points)

Bragg	*nts382*	*nts1116*
×	✓	✓

16. (**8 x 0.3** = 2.4 points)

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

17. (1.0 point)

a	b	c	d	e
✓	×	✓	×	×

18. (2 points)

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

19. (1 point- all or none)

a	b	c	d	e
×	✓	×	×	×

20. (2 points)

a	b	c	d	e
✓	✓	×	×	✓

21. (1.6 points)

a	b	c	d
✓	✓	✓	×

22. (1.5 points)

a	b	c
✓	×	✓

23. (0.6 point)

Grey matter	White matter
B	A

24. (1.2 points)

a	b	c	d	e	f
L	H	L	H	H	L

25. (1.5 points)

I	II	III
c	b	a

26. (1 point)

Answer: C

27. (4.5 points)

27.1. (3.6 points)

Q_{10} value	(i)	(ii)	(iii)
A	2.3	2.4	2.5
B	3.0	2.9	3.3
C	5.0	3.3	6.0

27.2. (0.9 points)

Ectotherm	Endotherm
C	A, B

28. (3.6 points)

28.1. (1 point)

Juvenile	Adult
C	B

28.2. (1 point – all or none)

Juvenile	Adult
A	B

28.3. (1.6 points)

a	b	c	d
×	✓	✓	×

29. (2.2 points)

29.1. (1.2 points)

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

29.2. (1.0 point)

The main factor is _____C_____.

30. (0.8 points)

a	b	c	d
×	✓	×	✓

31. (2 points)

a	b	c	d	e
×	×	×	×	✓

32. (1 point)

a	b	c	d	e
✓	✓	×	✓	×

33. (2 points)(allow if given in decimal points or in lowest form or in percentage)

33.1. (1 point)

Answer: 3/16.

33.2. (1 point)

Answer: 4/16.

34. (1.8 points)

	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
χ^2 (3 decimal places)	0.338
Hardy-Weinberg Equilibrium	✓

36. (4 points)

36.1. (2 points)

A	B	C	D
✓	×	×	✓

36.2. (2 points)

The probability is _____0_____.

37. (2.7 points)

37.1. (1.5 points)

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

37.2. (1.2 points)

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

38. (2 points) (allow if given in decimal points or in lowest form or in percentage)

38.1. (1 point)

Answer: _____1/6_____.

38.2. (1 point)

Answer: _____2/9_____.

39. (1 point) (all or none)

a	b	c	d	e
×	✓	×	×	×

40. (1 point)

I	II	III	IV	V
✓	×	✓	✓	✓

41. (1.4 points)

41.1. (0.8 point)

a	b	c	d
✓	×	✓	×

41.2. (0.6 point)

a	b	c
✓	×	×

41.3. (1 point)

a	b	c	d	e
×	✓	×	×	×

42. (5.1 points)

42.1. (2.4 points)

I	II	III	IV
b	a	d	c

42.2. (1.2 points)

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

42.3. (1.5 points)

a	b	c	d	e
✓	×	✓	✓	×

43. (1.2 points)

I	II	III	IV	V	VI
✓	✓	×	✓	✓	×

44. (1 point)

a	b	c	d	e
×	×	×	✓	×

45. (2.4 points)

a	b	c	d	e	f
✓	✓	×	✓	✓	×

46. (4.8 points)

46.1. (0.4 x 3 =1.2 points)

Taxonomic group	Y	X+Y	W+Z
Morphological character(s)	5	2	4

46.2. (1.2 points)

Chelicerata	Crustacea	Hexapoda	Myriapoda
Z	Y	W	X

46.3. (1.2 points)

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

46.4. (1.2 points)

Monophyletic	Paraphyletic	Polyphyletic
I, IV	II, III	

END OF PAPER