

Country: _____

Student Code: _____

23rd INTERNATIONAL BIOLOGY OLYMPIAD

8th – 15th July, 2012

SINGAPORE



PRACTICAL TEST 1

CELL & MOLECULAR BIOLOGY

ANSWER KEY

Total points: **100**

Duration: **90 minutes**

Task (100 points)

Gene mapping by restriction endonuclease digestion of DNA fragments

Part A. Confirmation of insertion of human DNA in a cloning plasmid. (80 points)

Q1.1 (2 points × 8 + 1 point × 4 = 20 points)

[We emphasize the important of “uncut” control (2 points × 4 entries) and the “double-cut” with both RE1 and RE2 to obtain more complete information (2 points × 4 entries). The remaining 4 entries (1 point each) being the single cut with RE2]

	Tube 1	Tube 2	Tube 3	Tube 4
DNA 'T' (with buffer)	10	10	10	10
RE1 (<i>NdeI</i>)	0 [2]	1	0 [1]	1 [2]
RE2 (<i>EcoRI</i>)	0 [2]	0	1 [1]	1 [2]
water	10 [2]	9	9 [1]	8 [2]
Total	20 [2]	20	20 [1]	20 [2]
	[8]		[4]	[8]

Q1.2 (2 points × 5 = 10 points) [understanding the properties of restriction enzymes]

a	b	c	d	e
✓	x	x	x	✓

Q1.3 (2 points × 5 = 10 points) [understanding the principles of DNA separation by size]

a	b	c	d	e
x	✓	x	✓	x

Q1.6 (1 point × 5 = 5 points)

	NdeI	EcoRI
	RE1	RE2
Number of fragments	2 (1 point)	1 (1 point)
Estimated size	Anything between 2.5 to 3.0 kbp for the larger fragment, and 0.75 kbp for the smaller fragment – but their total must be close to the total given in the question, i.e., 3.33 kbp) (2 points)	3.33 kbp (anything between 3.0 to 3.5 kbp) (1 point)

Q1.7 (1 point)

Answer: 3.33 kbp (between 3 and 3.5 kbp) .

Q1.8 (1 point) [for having one correct tick; no points if there are more than 1 ticks]

Larger	Smaller	Same size
✓		

Q1.9 (1 point)

Answer: ✓ .

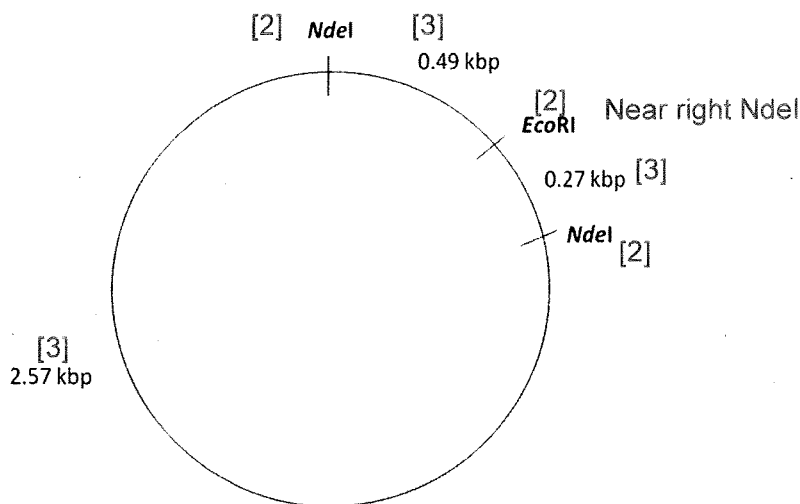
Q1.10 (2 points) [for having one correct tick; no points if there are more than 1 ticks]

a	b	c
	✓	

Part B. Determination of orientation by which fragment was inserted. (20 points)

Q1.11 (20 points)

1. **15 points.** 9 marks for translating the observation in gels to writing down the estimate sizes of the 3 fragments generated by RE1 and RE2, i.e 2.5 to 3.0 kbp for the largest (3 points), 0.5 to 0.6 for the medium size (3 points) and 0.3 to 0.4 for the smallest fragment (3 points). However, their total size must be close to the total given in the question, i.e. 3.0 to 3.5 kbp (3 points) and the values must be consistent with the ones quoted in their answers to Q6 (3 points). (Use enzyme names or RE1 and RE2).
2. **5 points** for proposing an alternative map (i.e., the relative position of EcoRI site to the flanking NdeI sites can be in two arrangements, see answers below).



With alternative model;

