56th INTERNATIONAL CHEMISTRY OLYMPIAD 2024

UK Round One

STUDENT ANSWER BOOKLET

In order to print your certificate, we need to store your name, school, and mark in a database: these details are only viewable by your school and the RSC Chemistry Olympiad Working Group.

Your participation in the competition indicates that you are happy for us to do this.

Please PRINT details clearly:

Name .....

Nationality .....

Date of birth .....

School Year (e.g., Year 12, Scottish Higher) .....

Date paper taken .....

School use:

Centre number .....

Question	1	2	3	4	5	Total
Marks Available	8	15	20	24	15	82
Marks Scored						

1.	This question is about Bronze				Mark
(a)	$[Ar]4d^{10}$	$[Ar]4d^{10}5s^{1}$	$[Kr]4d^{10}$	$[Kr]4d^{10}5s^{1}$	☐
(b)	$1s^{2}2s^{2}2p^{6}3s^{2}3p^{6}3d^{10}4s^{1}$		$1s^{2}2s^{2}2p^{6}3s^{2}3p^{6}3d^{10}$		☐
	$1s^{2}2s^{2}2p^{6}3s^{2}3p^{6}3d^{9}$		$1s^{2}2s^{2}2p^{6}3s^{2}3p^{6}4s^{2}3d^{9}$		
(c)					☐
(d)					☐
(e)					☐

(f)		
(g)		
	Total out of 8	

2.	This question is about iodate salts					Mark
(a)						
(b)						
(c)	<109.5°		109.5°		>109.5°	
(d)						
(e)	(i)					
	(ii) redox	electrophilic substitution	elimination	disproportionation	polymerisation	
(f)						

(g)

(h)

(i)

+(n+3)	+(n+2)	+(n+1)	+(n)	+(n−1)	+(n−2)	+(n−3)

(j)

(k)

$\mathbf{M^{n+}}$	Sc^{3+}	Fe^{2+}	Fe^{3+}	Cu^{+}	Cu^{2+}	Mg^{2+}	Ga^{2+}	Zn^{2+}
$\mathbf{Z^{m-}}$	F^{-}	Cl^{-}	Br^{-}	H^{-}	O^{2-}	OH^{-}	PO_4^{3-}	SO_3^{2-}

Total out of 15

3.	This question is about fuel-producing bacteria	Mark
(a)		
(b)	(i)	
	(ii)	
	(iii)	
	(iv)	
(c)		
(d)		

	The enolate intermediate acts a reducing agent; the iodomethane acts an oxidising agent.
	The enolate intermediate acts an oxidising agent; the iodomethane acts a reducing agent.
	The enolate intermediate acts an electrophile; the iodomethane acts a nucleophile.
	The enolate intermediate acts a nucleophile; the iodomethane acts an electrophile.
	The enolate intermediate acts an acid; the iodomethane acts a base.
	The enolate intermediate acts a base; the iodomethane acts an acid.

(e)

(f) (i)

B	C
D	E

(ii)

step 1	step 2	step 3	step 4	step 5

(g)

oxidation	reduction	condensation	hydrolysis	isomerisation	elimination

(h)

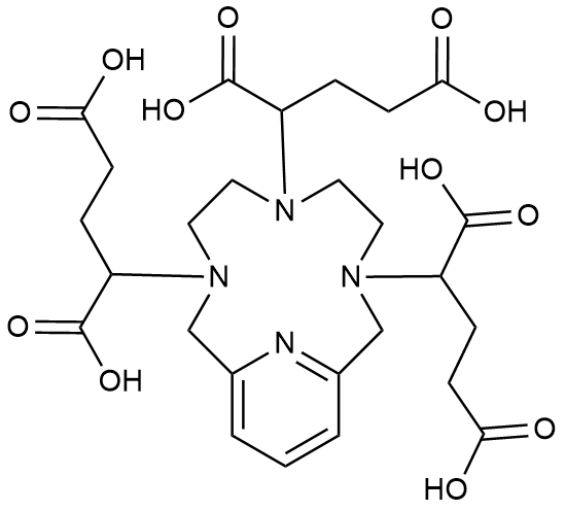
X

Y

(i)

first enzyme required for process	second enzyme required for process	third enzyme required for process	last enzyme required for process

Total out of 20

4.	This question is about the MRI contrast agent gadopiclenol	Mark
(a)	**A** / **B** / **C** / **D**	☐ ☐ ☐ ☐
(b)		☐ ☐

(c)

E

F

G

(d)

(e)

radiowave	microwave	IR	visible	UV	X-ray	gamma ray

(f)

(g)

(h)		
(i)		

(j)

(k)

Total out of 24

5. **This question is about sulfur-containing molecules in the atmosphere** **Mark**

(a)

B	**C**	**E**

(b) (i)

(ii)

(c)

(d)

(e)

	Forming **J**•	Forming **N**•
Loss of a H^+		
Loss of a H•		
Loss of a H^-		
Reduction of sulfur		
Oxidation of sulfur		
Atomisation		
Radical substitution		
Radical addition		

(f)		
(g)		
(h)		
	Total out of 15	