National Qualifications 2016

X713/77/02

Chemistry
Section 1 — Questions

WEDNESDAY, 18 MAY

9:00 AM – 11:30 AM

Instructions for the completion of Section 1 are given on *Page 02* of your question and answer booklet X713/77/01.

Record your answers on the answer grid on *Page 03* of your question and answer booklet.

Reference may be made to the Chemistry Higher and Advanced Higher Data Booklet.

Before leaving the examination room you must give your question and answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SQA ©

X7137702

SECTION 1 — 30 marks

Attempt ALL questions

1. Which of the following lists electromagnetic radiation bands in order of increasing wavelength?

A X-ray, infrared, ultraviolet, radio

B Infrared, ultraviolet, X-ray, gamma

C Ultraviolet, visible, infrared, radio

D Radio, infrared, visible, gamma

2. Which of the following states that electrons fill orbitals in order of increasing energy?

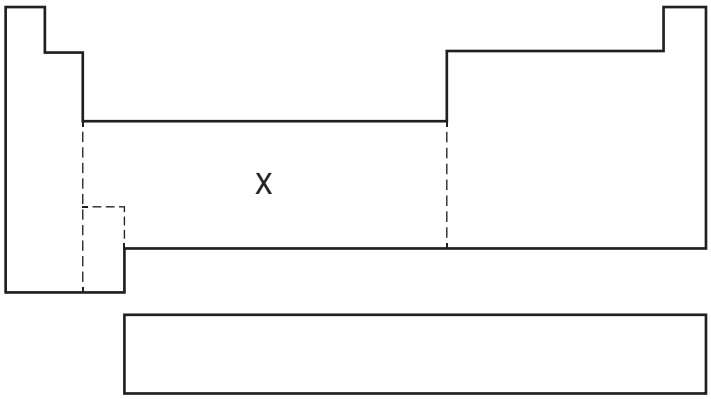
A Hund's rule

B The aufbau principle

C The Pauli exclusion principle

D The valence shell electron pair repulsion theory

3.



In the periodic table outlined above, one area is marked X. Moving across area X, from one element to the next, the extra electron usually occupies an orbital of type

A s

B p

C d

D f.

4. Which of the following molecules contains three atoms in a straight line?

A BF_3

B CH_4

C H_2O

D SF_6

5. The complex ion $[Cu(CN)_6]^{4-}$ is called

A hexacyanocopper(II)
B hexacyanocopper(IV)
C hexacyanocuprate(II)
D hexacyanocuprate(IV).

6. $HCN(aq) + H_2O(\ell) \rightleftharpoons H_3O^+(aq) + CN^-(aq)$
In the above equation HCN(aq) is acting as

A an acid
B a conjugate acid
C a base
D a conjugate base.

7. The use of an indicator is **not** appropriate in titrations involving

A hydrochloric acid solution and methylamine solution
B nitric acid solution and potassium hydroxide solution
C methanoic acid solution and ammonia solution
D propanoic acid solution and sodium hydroxide solution.

8. Which of the following can produce a buffer solution when added to aqueous NH_4Cl?

A Ammonia
B Ethanoic acid
C Potassium chloride
D Ammonium sulfate

9. Which of the following reactions **cannot** be described as an enthalpy of formation?

A $Si(s) + 4Cl(g) \rightarrow SiCl_4(\ell)$
B $Mg(s) + \frac{1}{2}O_2(g) \rightarrow MgO(s)$
C $C(s) + 2H_2(g) + \frac{1}{2}O_2(g) \rightarrow CH_3OH(\ell)$
D $2C(s) + 3H_2(g) \rightarrow C_2H_6(g)$

[Turn over

10. Which of the following is likely to have the lowest standard entropy at 100 °C?

A Neon
B Mercury
C Sulfur
D Phosphorus

11. For the reaction

$2A + 2B \rightarrow C$

the rate equation is

rate = $k[A][B]^2$.

Which of the following could be a possible mechanism for this reaction?

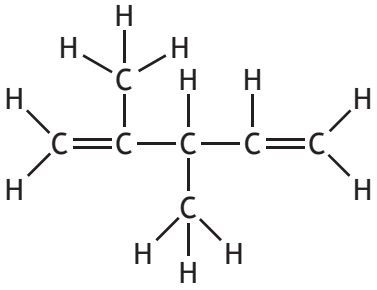
A $A + B \rightarrow X$ (fast)
$X + A + B \rightarrow C$ (slow)

B $A + 2B \rightarrow X$ (slow)
$X + A \rightarrow C$ (fast)

C $2A + B \rightarrow X$ (slow)
$X + B \rightarrow C$ (fast)

D $2A + B \rightarrow X$ (fast)
$X + B \rightarrow C$ (slow)

12. Which line in the table has the correct number and type of bonds in the structure shown?

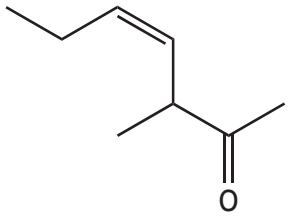


	Number of σ-bonds	*Number of π-bonds*
A	2	18
B	4	16
C	16	4
D	18	2

13. 5-Methylhept-3-ene-2-one is an aroma molecule found in some types of tea.

Which of the following shows a structural formula for the *trans*-isomer of 5-methylhept-3-ene-2-one?

A



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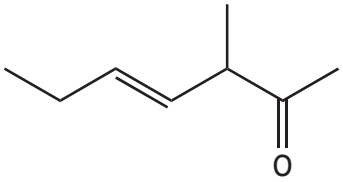

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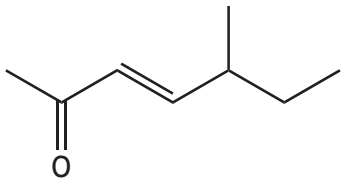

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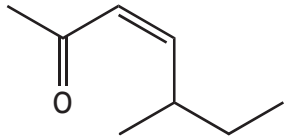


14. Which of the following does **not** exhibit hydrogen bonding between its molecules?

A Ethanol

B Ethylamine

C Ethanoic acid

D Ethoxyethane

15. In the homologous series of amines, an increase in chain length is accompanied by

	Volatility	*Solubility in water*
A	increased	increased
B	decreased	decreased
C	increased	decreased
D	decreased	increased

16. Which of the following will react together to produce 2-ethoxypropane?

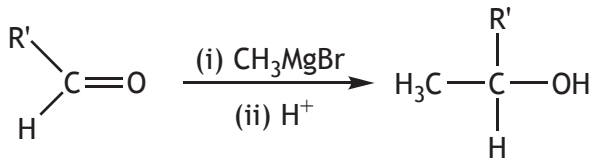
A CH_3CH_2OH and CH_3CH_2COONa

B CH_3CH_2ONa and $CH_3CH_2CH_2Br$

C $CH_3CH(OH)CH_3$ and CH_3COONa

D CH_3CH_2ONa and $CH_3CHBrCH_3$

17. Aldehydes can be converted into alcohols by the reaction shown



Which of the following aldehydes would produce a primary alcohol?

A Methanal

B Ethanal

C Propanal

D Butanal

18. $CH_3CHO + NH_2NH_2 \rightarrow CH_3CH = NNH_2 + H_2O$

This reaction is an example of

A hydration

B hydrolysis

C dehydration

D condensation.

19. When but-1-ene reacts with hydrogen chloride, 1-chlorobutane and 2-chlorobutane are formed. According to Markovnikov's rule

A there will be more 2-chlorobutane than 1-chlorobutane

B there will be more 1-chlorobutane than 2-chlorobutane

C there will be equal proportions of both products

D it is impossible to tell the relative proportion of each product.

20. When 2-bromobutane reacts with ethanolic potassium cyanide and the compound formed is hydrolysed with dilute acid, the final product is

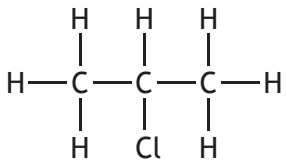
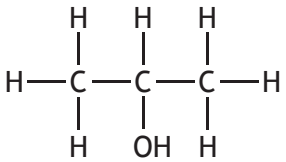
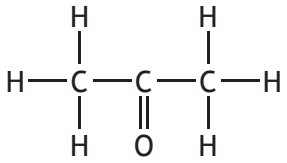
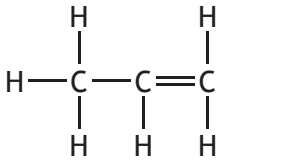
A butanoic acid

B pentanoic acid

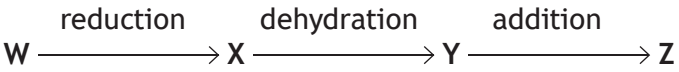
C 2-methylbutanoic acid

D 2-methylpentanoic acid.

21.

 **1**	 **2**
 **3**	 **4**

Which line in the table correctly identifies **W**, **X**, **Y** and **Z** in the reaction sequence?



	W	*X*	*Y*	*Z*
A	1	4	2	3
B	3	2	1	4
C	3	2	4	1
D	4	1	2	3

22. Which of the following statements about benzene is **not** true?

A It is planar.

B It is susceptible to attack by electrophilic reagents.

C Its carbon to carbon bonds are equal in length.

D It is readily attacked by bromine.

[Turn over

23. $(CH_3)_3CBr + OH^- \rightarrow (CH_3)_3COH + Br^-$

The above reaction proceeds via an S_N1 mechanism.

What effect will doubling the concentration of hydroxide ions have on the reaction rate?

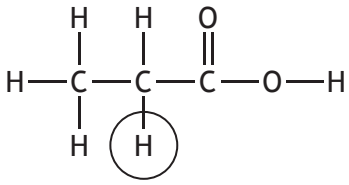
A It will have no effect.

B The reaction rate will halve.

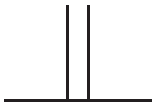
C The reaction rate will double.

D The reaction rate will increase by a factor of four.

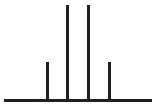
24.

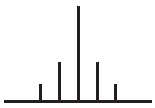


Which of the following shows the splitting pattern for the circled **H** atom above, in a high resolution proton NMR spectrum?

A 

B 

C 

D 

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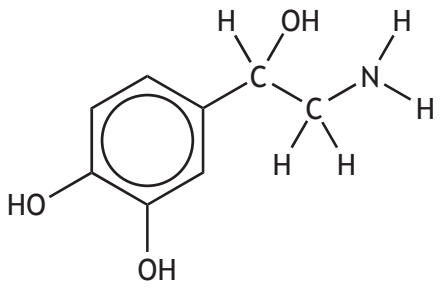
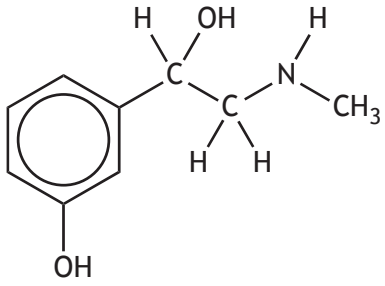
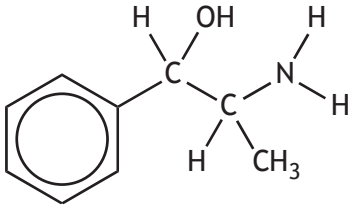


Noradrenaline



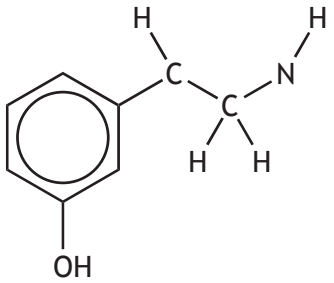
Phenylephrine

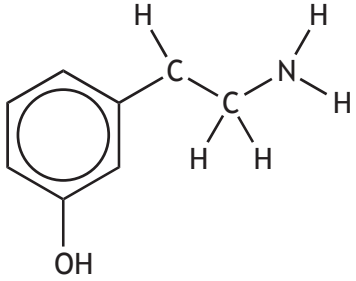


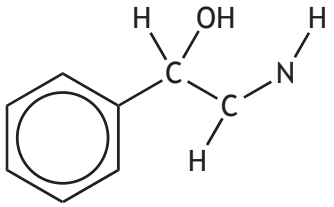
Amphetamine

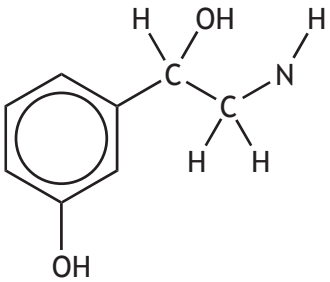
Noradrenaline and phenylephrine stimulate receptors in the body resulting in increased blood pressure. Amphetamine has the same effect but works indirectly in the body by stimulating production of noradrenaline.

The structural fragment acting **directly** on the receptor is

A 

B 

C 

D 

[Turn over

26. In a UK workplace, the maximum short-term exposure limit for carbon monoxide is 200 ppm in a 15 minute period.

If a person breathes in 134 g of air in a 15 minute period, what is the mass of carbon monoxide breathed in at the maximum short-term exposure limit?

A 1·49 mg

B 26·8 mg

C 1·49 g

D 26·8 g

27. Sodium hydroxide is unsuitable for use as a primary standard because it

A is corrosive

B is readily soluble in water

C is available in a high degree of purity

D readily absorbs water from the atmosphere.

28. What volume of 0·25 mol l^{-1} calcium nitrate is required to make, by dilution with water, 500 cm^3 of a solution with a **nitrate** ion concentration of 0·1 mol l^{-1}?

A 50 cm^3

B 100 cm^3

C 200 cm^3

D 400 cm^3

29. 1·60 g of an anhydrous metal sulfate were dissolved in water. Addition of excess barium chloride solution resulted in the precipitation of 2·33 g of barium sulfate.

The original substance was

A copper(II) sulfate

B magnesium sulfate

C sodium sulfate

D calcium sulfate.

30. 0·020 moles of the salt $Pt(NH_3)_xCl_2$ required 20·0 cm^3 of 4·0 mol l^{-1} nitric acid to react completely with the NH_3 ligands.

The value of x is

A 2

B 4

C 6

D 8.

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET]

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