

1 The bond angle in beryllium chloride, BeCl_2 , is most likely to be

- A 90°
- B 104.5°
- C 120°
- D 180°

(Total for Question = 1 mark)

2 Copper(II) ions combine with three molecules of 1,2-diaminoethane, $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$, to form a complex ion.

A bond angle, $\text{N} - \text{Cu} - \text{N}$, in this complex is

- A 120°
- B 109.5°
- C 107°
- D 90°

(Total for Question = 1 mark)

3 Which of the following does **not** have a central metal ion having six bonds and an oxidation state of +2?

- A $[\text{Cu}(\text{C}_2\text{O}_4)_3]^{4-}$
- B $[\text{Co}(\text{CN})_5(\text{H}_2\text{O})]^{3-}$
- C $[\text{Fe}(\text{CN})_6]^{3-}$
- D $[\text{Zn}(\text{OH})_4(\text{H}_2\text{O})_2]^{2-}$

(Total for Question = 1 mark)

4 This question concerns the shapes of the hydrides of Group 5 elements.

(a) What is the approximate H—N—H bond angle in the ammonium ion, NH_4^+ ?

(1)

- A 90°
- B 104.5°
- C 107°
- D 109.5°

(b) Suggest the shape of the phosphine molecule, PH_3 .

(1)

- A Trigonal planar
- B Trigonal pyramidal
- C Trigonal bipyramidal
- D Octahedral

(Total for Question = 2 marks)

5 Which of the following molecules is polar?

- A CO_2
- B SO_2
- C SO_3
- D O_2

(Total for Question = 1 mark)

6 Which of the following molecules has the smallest bond angle?



(Total for Question = 1 mark)

7 A charged rod is held beside a stream of liquid coming from a burette. Which of the following liquids would NOT be significantly deflected?



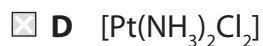
(Total for Question = 1 mark)

8 Which of the following molecules has a linear shape and bond angles of 180° ?



(Total for Question = 1 mark)

9 Which of the following is **not** planar?



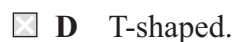
(Total for Question = 1 mark)

10 The oxygen atom in a molecule of water has two bonding pairs and two lone pairs of electrons. Based on the electron-pair repulsion theory, the H O H bond angle is most likely to be



(Total for Question 1 mark)

11 The shape of a molecule of boron trifluoride, BF_3 , is



(Total for Question 1 mark)

12 What is the FBF bond angle in boron trifluoride, BF_3 ?

- A 180°
- B 120°
- C 109.5°
- D 90°

(Total for Question 1 mark)

13 Which of the following molecules is linear?

- A CO_2
- B C_2H_4
- C H_2O
- D NH_3

(Total for Question 1 mark)

14 Which of the following molecules is **non-polar**?

- A CH_3Cl
- B CH_2Cl_2
- C CHCl_3
- D CCl_4

(Total for Question 1 mark)

15 This question is about bond angles.

A 90°

B 104°

C 107°

D 109.5°

Select, from A to D above, the most likely value for the bond angle of

(a) HCH in methane, CH_4 .

(1)

A

B

C

D

(b) FSF in sulfur hexafluoride, SF_6 .

(1)

A

B

C

D

(c) FOF in oxygen difluoride, OF_2 .

(1)

A

B

C

D

(Total for Question = 3 marks)

16 Which of the following molecules is polar?

- A Carbon dioxide, CO_2
- B Beryllium chloride, BeCl_2
- C Ammonia, NH_3
- D Boron trifluoride, BF_3

(Total for Question = 1 mark)

17 Which of these bond angles is the smallest?

- A HNH in NH_3
- B HCH in CH_4
- C HOH in H_2O
- D OCO in CO_2

(Total for Question = 1 mark)

18 Which statement best describes the shape and bond angles in the molecule SF_6 ?

- A Octahedral, 90° and 180°
- B Trigonal bipyramidal, 90° and 180°
- C Octahedral, 90° and 120°
- D Trigonal bipyramidal, 90° and 120°

(Total for Question = 1 mark)

19 An electric field can affect the direction of a stream of some liquids. Which of these liquids would be affected by an electric field?

- A 1-chloropropane
- B Pentane
- C Tetrachloromethane
- D Cyclopentane

(Total for Question = 1 mark)

20 Which of these bond angles is the **largest**?

- A Cl—B—Cl in BCl_3
- B H—N—H in NH_3
- C Cl—Be—Cl in BeCl_2
- D H—O—H in H_2O

(Total for Question = 1 mark)

21 Which of the following molecules is **not** polar?

- A HCl
- B CH_3Cl
- C CHCl_3
- D CCl_4

(Total for Question = 1 mark)

22 This question concerns the shapes of molecules and ions:

- A linear
- B trigonal planar
- C pyramidal
- D tetrahedral

Select from **A to D** the shape of

(a) boron trichloride, BCl_3

(1)

- A
- B
- C
- D

(b) the ammonium ion, NH_4^+

(1)

- A
- B
- C
- D

(c) carbon dioxide, CO_2

(1)

- A
- B
- C
- D

(Total for Question 3 marks)

- 23 Tetrachloromethane, CCl_4 , is a
- A polar molecule with polar bonds.
 - B polar molecule with non-polar bonds.
 - C non-polar molecule with polar bonds.
 - D non-polar molecule with non-polar bonds.

(Total for Question = 1 mark)

- 24 Which of the following bond angles occur in a molecule of ethanol, $\text{C}_2\text{H}_5\text{OH}$?

- A 90° and 180°
- B 104.5° and 180°
- C 104.5° and 109.5°
- D 109.5° and 120°

(Total for Question = 1 mark)

- 25 Which of the following molecules is linear?

- A Carbon dioxide, CO_2
- B Sulfur dioxide, SO_2
- C Water, H_2O
- D Methanal, HCHO

(Total for Question = 1 mark)

- 26 Which of the following molecules contains polar bonds but is **not** a polar molecule?

- A Chlorine, Cl_2
- B Hydrogen chloride, HCl
- C Trichloromethane, CHCl_3
- D Tetrachloromethane, CCl_4

(Total for Question = 1 mark)