

Name: KEY - form AE

Free-Response ANSWER SHEET

(MC score 26 FR score 80 Total raw 158 total % 79)

26 x 3 = 78

78 MC + 80 FR = 158

← divide your "total raw" by 158 & record as a %

1. Give a reasonable estimate, with appropriate metric unit, for each of the following. [2 each]

a. the mass of your little finger. 10g (accepted: 2g-100g)

b. the height of a coffee cup. 10 cm (3 cm - 30 cm)

c. the volume of your textbook. 2L (0.2L-3L)

2. Give the symbol of an element that fits each description. In some cases, there may be more than one acceptable answer; choose one. [2 each]

Li the alkali metal in period 2

Ge, Sn, Pb a metal in the same group with silicon

Sc, Ti, ..., Zn a transition metal in Period 4

O, S, Se, Te, Po an element whose neutral atoms have 6 valence electrons

N, P, As an atom that normally forms 3 bonds in covalent compounds

4. Give a correct systematic name for each formula. [2 each]

14 disulfur hexafluoride S₂F₆

iron(III) sulfide Fe₂S₃

phosphorus trichloride PCl₃

ammonium hydroxide NH₄OH

methane CH₄

dinitrogen trioxide N₂O₃

aluminium carbonate Al₂(CO₃)₃

5. Give the correct chemical formula for each substance named. [2 each]

C₂H₂ H-C≡C-H ethyne ① any CH

14 NH₃ ammonia ① NH₄⁺

Mg₃P₂ magnesium phosphide

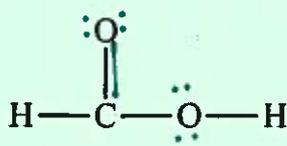
SiBr₄ silicon tetrabromide

Zn(NO₃)₂ zinc nitrate

CaSO₄ calcium sulfate

Cu₂(PO₄)₂ copper(II) phosphate

3. [5 pts] Complete the structure: Add lone pair electrons, or turn single bonds into double or triple bonds, as needed so that every atom has its normal electron arrangement. (Do not add any atoms to the molecule.) ① each atom



section totals ↓ 6

10

5

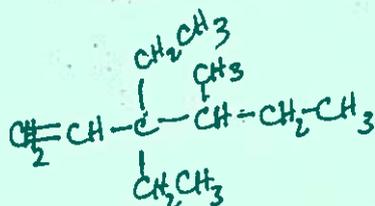
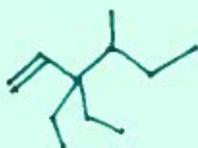
49 ← page total

6. Fill in the blanks in the table below. [1 point each]

| formula | atomic number | mass number | # of protons | # of electrons | # of neutrons | charge |
|------------------|---------------|------------------|----------------|----------------|---------------|--------|
| S | 16 | 33 | $33 - 17 = 16$ | 16 | 17 | 0 |
| Cu ⁺ | 29 | $29 + 35 = 64$ | 29 | 28 | 35 | +1 |
| Tl ³⁺ | 81 | $81 + 124 = 205$ | 81 | 78 | 124 | +3 |

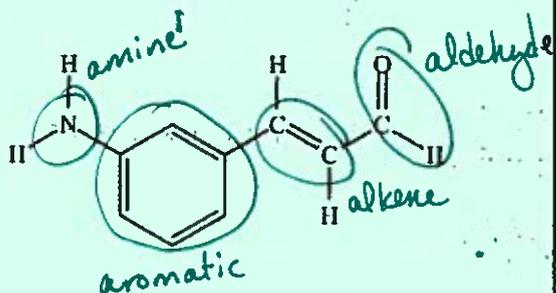
7. [10 pts] In the space below, draw the structure of 3,3-diethyl-4-methyl-1-hexene.

10

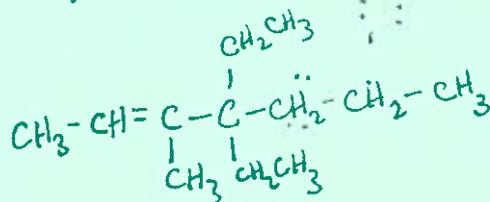


8. In the structure below, circle and appropriately label all functional groups. [8 pts]

8



form BE: 4,4-diethyl-3-methyl-2-heptene



31 ← page total

Check back over your exam and make sure you have completed all parts before turning in your paper!

Multiple Choice [3 points each]. Choose the best answer and record it on your Scantron card.

1 Which of the following is a characteristic of a sample of a **mixture**?

- A All atoms have the same number of protons
- B All atoms have the same number of neutrons
- C Is made up of other, simpler substances in a fixed ratio
- D Is made up of other, simpler substances in a variable ratio
- E Appears in the periodic table

2 Which of the following properties is generally true of a **halogen**?

- A conducts electricity
- B usually solid at room temperature
- C forms anions in ionic compounds
- D combines with other nonmetals to form ionic compounds
- E relatively unreactive and does not form compounds

3 Which of the following is the name of an **organic compound**?

- A carbon disulfide
- B silicon carbide
- C propane
- D carbon
- E sodium carbonate

4 From the following list, which statement could possibly be correct based on the size of the measurement?

- A A mouse is 9 cm long.
- B My kitchen sink has a capacity of 22 μL of water.
- C The width of Bob's classroom is 8.1 mm.
- D This plastic drinking cup weighs 85 kg.

5 You have an atom that contains 16 protons, 17 neutrons, and 18 electrons. What is its mass number?

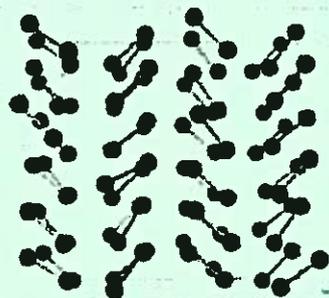
- A -2
- B 16
- C 17
- D 32.07
- E 33

protons + neutrons = 16 + 17 = 33

6 The sample pictured is best classified as:

- A an element.
- B an ionic compound.
- C a covalent/molecular compound.
- D a homogeneous mixture.
- E a heterogeneous mixture.

all atoms alike



7 Which of the following statements is the most accurate description of the substance PH_3 ?

- A PH_3 is an ionic compound, containing P^{3+} and H^- ions.
- B PH_3 is an ionic compound, containing P^{3-} and H^+ ions.
- C PH_3 is a covalent compound, containing P atoms and H_3 molecules.
- D PH_3 is a covalent compound, in which P and H are connected through covalent bonds.

8 Which of these is a **saturated organic molecule**?

- A propene *$\text{CH}_3\text{-CH}=\text{CH}_2$*
- B carbon dioxide *CO_2*
- C octane *$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$*
- D ethyne
- E cyclopentene

all CC bonds are single

> C & H (at least)

Items 9-18 refer to the following five options. You may use each option once, more than once, or not at all.

A N

B Cl

C Ne

D Na

E Fe

- D 9 Which element forms a +1 ion exclusively? *Group 1A: Na*
- A 10 Which element forms a -3 ion? *Group 5A: N*
- B 11 Which element combines in a 1:1 ratio with potassium to form an ionic compound? *need nonmetal K^+ KCl*
- C 12 Which element does not form compounds? *Group 8A*
- E 13 Which element forms cations that need Roman numerals to specify their charges in the names of compounds? *Transition metal, or metal in 4A/5A/6A*
- E 14 If you have a 1-mole sample of each element, which sample has the greatest mass? *Same # of atoms \rightarrow heaviest element: Fe*
- B 15 Which element is a halogen? *Group 7A*
- E 16 Which of the elements is a transition metal? *B groups*
- D 17 Which element has one valence electron in its neutral atoms? *Group 1A*
- A or B 18 Which element has the highest electronegativity? *\rightarrow N or Cl (either accepted)*

The descriptions in Items 19-23 refer to the following five options. You may use each option once, more than once, or not at all.

A Na

B O₂

C Cl

D NaCl

E ClO₂

B 19 A diatomic molecule *2 atoms, covalent bond B*

B 20 A substance with a molar mass of 32 g *O₂: 16 + 16 = 32 g/mol*

A 21 A metallic element

E 22 A molecular/covalent compound *nonmetals \rightarrow 2+ elements*

D 23 An ionic compound *metal + nonmetal*

24 How many **bonding electrons** are there in a molecule of methanol (shown at right)?

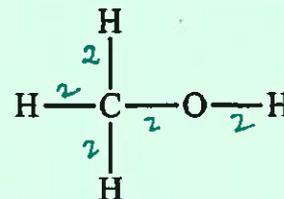
A 4

B 5

C 10

D 14

E 18



25 How many **carbon atoms** are there in the molecule shown at right?

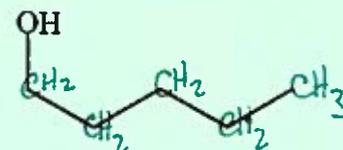
A 0 (this molecule does not contain carbon)

B 5

C 6

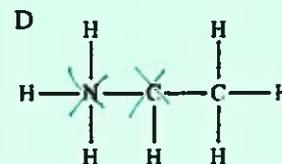
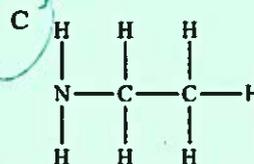
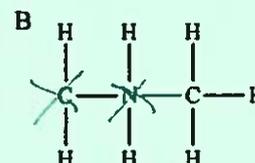
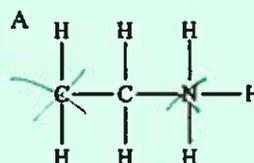
D 10

E 22



26 Based on the normal bonding patterns of the atoms involved, which of the structures shown is most likely to exist?

C: 4 bonds
N: 3 bonds
H: 1 bond



27 Mark both the "A" and "E" spaces on your Scantron card. (This item is a form identifier and will not be scored.)

SUBJECTIVE SCORE INSTRUCTOR USE ONLY

| | | | | |
|-----|----|----|----|----|
| 100 | 90 | 80 | 70 | 60 |
| 50 | 40 | 30 | 20 | 10 |
| 9 | 8 | 7 | 6 | 5 |
| 4 | 3 | 2 | 1 | 0 |

PART 1

(T) (F) KEY

100 90 80 70 60

50 40 30 20 10

9 8 7 6 5

4 3 2 1 0

1 (A) (B) (C) (D) (E)

2 (A) (B) (C) (D) (E)

3 (A) (B) (C) (D) (E)

4 (A) (B) (C) (D) (E)

5 (A) (B) (C) (D) (E)

6 (A) (B) (C) (D) (E)

7 (A) (B) (C) (D) (E)

8 (A) (B) (C) (D) (E)

9 (A) (B) (C) (D) (E)

10 (A) (B) (C) (D) (E)

11 (A) (B) (C) (D) (E)

12 (A) (B) (C) (D) (E)

13 (A) (B) (C) (D) (E)

14 (A) (B) (C) (D) (E)

15 (A) (B) (C) (D) (E)

16 (A) (B) (C) (D) (E)

17 (A) (B) (C) (D) (E)

18 (A) (B) (C) (D) (E)

19 (A) (B) (C) (D) (E)

20 (A) (B) (C) (D) (E)

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22 (A) (B) (C) (D) (E)

23 (A) (B) (C) (D) (E)

24 (A) (B) (C) (D) (E)

25 (A) (B) (C) (D) (E)

26 (A) (B) (C) (D) (E)

27 (A) (B) (C) (D) (E)

28 (A) (B) (C) (D) (E)

29 (A) (B) (C) (D) (E)

30 (A) (B) (C) (D) (E)

31 (A) (B) (C) (D) (E)

32 (A) (B) (C) (D) (E)

33 (A) (B) (C) (D) (E)

34 (A) (B) (C) (D) (E)

35 (A) (B) (C) (D) (E)

36 (A) (B) (C) (D) (E)

37 (A) (B) (C) (D) (E)

38 (A) (B) (C) (D) (E)

39 (A) (B) (C) (D) (E)

40 (A) (B) (C) (D) (E)

41 (A) (B) (C) (D) (E)

42 (A) (B) (C) (D) (E)

43 (A) (B) (C) (D) (E)

44 (A) (B) (C) (D) (E)

45 (A) (B) (C) (D) (E)

46 (A) (B) (C) (D) (E)

47 (A) (B) (C) (D) (E)

48 (A) (B) (C) (D) (E)

49 (A) (B) (C) (D) (E)

50 (A) (B) (C) (D) (E)

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- MAKE DARK MARKS
- ERASE COMPLETELY TO CHANGE
- ERASE COMPLETELY TO CHANGE

EXAMPLE: A B C D E

TO USE SUBJECTIVE SCORE FEATURE:

- Mark total possible subjective points
- Only one mark per line on key
- 153 points maximum

EXAMPLE OF STUDENT SCORE: 153

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| 50 | 40 | 30 | 20 | 10 |
| 9 | 8 | 7 | 6 | 5 |
| 4 | 3 | 2 | 1 | 0 |

PART 1

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- MAKE DARK MARKS
- ERASE COMPLETELY TO CHANGE
- EXAMPLE: A B C D E

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- Only one mark per line on key
- 163 points maximum

EXAMPLE OF STUDENT SCORE:

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|---|---|---|---|---|---|---|---|---|----|
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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

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|----|-----|-----|-----|
| 1 | | B | C |
| 2 | A | B | C |
| 3 | A | B | C |
| 4 | A | B | C |
| 5 | A | B | C |
| 6 | A | B | C |
| 7 | A | B | C |
| 8 | A | B | C |
| 9 | A | B | C |
| 10 | A | B | C |
| 11 | A | B | C |
| 12 | A | B | C |
| 13 | A | B | C |
| 14 | A | B | C |
| 15 | A | B | C |
| 16 | A | B | C |
| 17 | A | B | C |
| 18 | A | B | C |
| 19 | A | B | C |
| 20 | A | B | C |
| 21 | A | B | C |
| 22 | A | B | C |
| 23 | A | B | C |
| 24 | A | B | C |
| 25 | A | B | C |
| 26 | A | B | C |
| 27 | A | B | C |
| 28 | A | B | C |
| 29 | A | B | C |
| 30 | A | B | C |
| 31 | A | B | C |
| 32 | A | B | C |
| 33 | A | B | C |
| 34 | A | B | C |
| 35 | A | B | C |
| 36 | A | B | C |
| 37 | A | B | C |
| 38 | A | B | C |
| 39 | A | B | C |
| 40 | A | B | C |
| 41 | A | B | C |
| 42 | A | B | C |
| 43 | A | B | C |
| 44 | A | B | C |
| 45 | A | B | C |
| 46 | A | B | C |
| 47 | A | B | C |
| 48 | A | B | C |
| 49 | A | B | C |
| 50 | A | B | C |