Chemist: [redacted]

UNIT 4 – Organic Chemistry TEST 2

(Assessment of Learning)

(Haynes)

Knowledge:	10 /11
Thinking & Investigation:	10 /10
Communication:	7 /7
Application:	9 /10

KNOWLEDGE & UNDERSTANDING [11 marks]

For each of the following questions, record the ***best*** answer in the answer key provided.

MULTIPLE CHOICE – Answer Key

1	A	B	C	D	E	*4*	A	B	C	D	E
2	A	B	C	D	E	*5*	A	B	C	D	E
3	A	B	C	D	E	*6*	A	B	C	D	E

5

1. Which of the following are **structural isomers of C_4H_8O?**

$CH_3-CH_2-CH_2-C$ ~~I.~~ butanoic acid II. butanone III. butan-2-ol

A. I only
B. II only
C. I and III only
D. II and III only
E. I, II and III

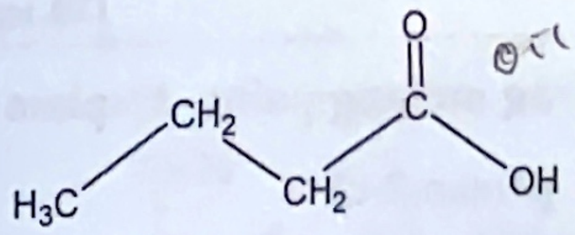
2. Which statement(s) about a **functional group** is/are correct?

counter eg: double bond triple bond.

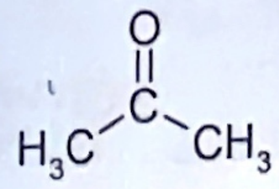
A. A functional group is always a separate group attached to the main chain of a molecule
B. A functional group will affect only the chemical properties of a molecule
C. A functional group will affect only the physical properties of a molecule
D. A functional group will affect both the physical and chemical properties of a molecule
E. Two of the above are correct.

3. Which of the following represents a **ketone**?

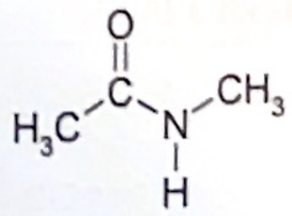
A



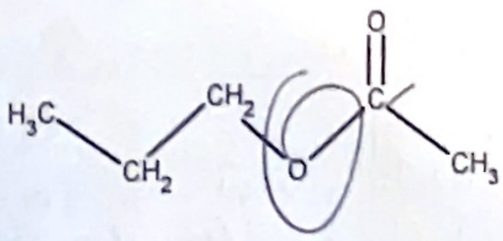
B



C



D



E Both B and D are ketones

4. Which compound is a likely product of the addition of HBr to but-1-ene?

A. $(Br)CH_2CH_2CH_2CH_2(Br)$
B. $CH_3CH_2C(Br)_2CH_3$
C. $CH_3CH_2CH(Br)CH_3$
D. $CH_3CH_2CH_2CH_2(Br)$
E. Both C and D are correct

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5. Which of the following compounds are **aromatic hydrocarbons**?

I. toluene ✓ II. phenol ✓ III. 3-methylcyclohexene

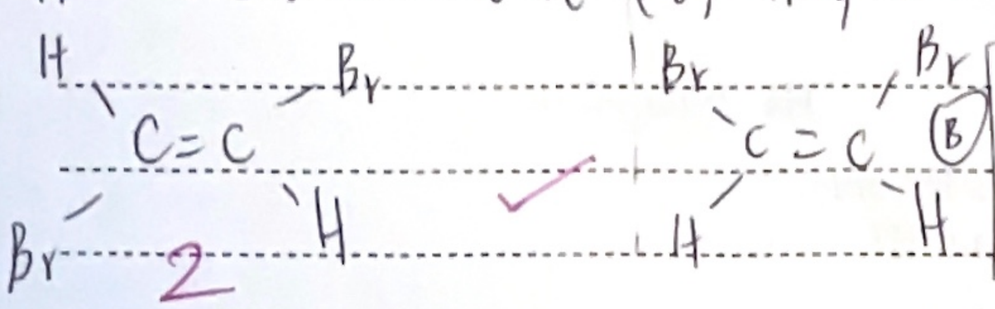
A. I and II
B. I and III
C. II and III
D. I, II and III
E. only one of the above is aromatic

6. Which compound will be **least soluble in** water?

A. $CH_3CH_2CH_2OH$
B. $CH_3CH_2COCH_3$
C. $CH_3CH_2CH_2CH_3COH$
D. CH_3CH_2COOH
E. $CH_3C(CH_3)_2CH_3$

7. Draw a diagram to explain the difference between (E)-1,2-dibromoethene and (Z)-1,2-dibromoethene. **(2)**

(E)-1,2-dibromoethene (Z)-1,2-dibromoethene



2

For (A), the priortized group would cross the double ~~line~~ bond (on 2 sides of double bond), while for (B), the 2 priortized group would be at the same side of double bond

8. The following three-step reaction was carried out.

$$C_4H_6 \xrightarrow{\text{I}} C_4H_8 \xrightarrow{\text{II}} C_4H_9OH \xrightarrow{\text{III}} C_3H_8COOH$$

a) Identify the **name of the specific type of reaction** for each step **(3)**

3

I) hydrogenation ✓
II) hydration ✓
III) oxidation ✓

THINKING AND INVESTIGATION [10 marks]

9. Arrange the following compounds in order of **increasing melting point**. **Explain** your answer. **(4)**

pent-2-ene pentan-2-one pentan-2-ol

4

pent-2-ene < pentan-2-one < pentan-2-ol.

In pent-2-ene there's only London Dispersion Force ~~inside~~ between the molecules which is a weak intermolecular forces. Moreover, due to ~~its~~ the bent structure of double bond in pent-2-ene, the molecules cannot pack ~~already~~ closely, causing the London Dispersion Force (LDF) weaker, resulting in lowest melting point among 3. Then, since ~~pentan-2-one~~ with its ketone group can form dipole-dipole attraction with other molecules, it requires more energy to overcome the intermolecular force of pentan-2-one than pent-2-ene. ~~Lastly, as pentan-2-ol~~ as dipole-dipole attraction is stronger than LDF. Lastly, pentan-2-ol has the ~~hi~~ highest melting point among 3 as it can form hydrogen bonding with other molecule with its hydroxyl group. As hydrogen bonding requires a lot of energy to overcome, it has higher melting point than the other two.

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10. Two acyclic compounds, **W and X, both have** the formula C_3H_7OH. A scientist carries out a series of reactions to try to work out the structural formula of W and X.

Initial Compound	First reaction: limited $KMnO_4$ / H^+ (distillation)	Second reaction: $K_2Cr_2O_7$ /H^+ (reflux)
W	reaction	no reaction
X	reaction	reaction

2° alcohol
1° alcohol

Use the information above to **suggest structures** (using condensed structural diagrams or line diagrams) **for W and X** **(2)**

W: $CH_3-CH(OH)-CH_3$ ✓

X: $CH_3-CH_2-CH_2-OH$ ✓

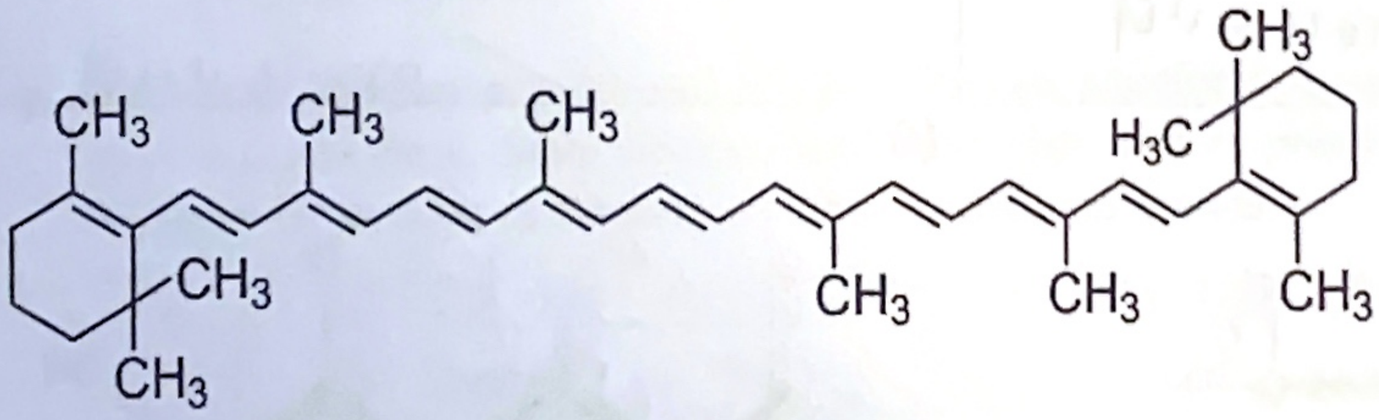
2

Explain your reasoning *(note there may be more than one correct answer for each structure – you only need to suggest one)* **(2)**

As W can only be oxidized once, we know it is oxidization as $KMnO_4$ and $K_2Cr_2O_7$ are both oxidizing agent. secondary alcohol can only be oxidized ~~least~~ once as there's only 1 hydrogen atom bonded to the carbon atom that hydroxyl group lies on. After the first reaction, there's no hydrogen bonded to that specific C allows for oxidation. Thus, I drew a 2° alcohol which has the formula of C_3H_7OH. 2

See attached.

11. Beta-carotene (below) is an unsaturated compound.



a) State what is meant by the term **unsaturated.** **(1)** 1

Unsaturated means the carbon atom(s) in the compound is not bonded with maximum number of hydrogen atom, compound with multiple bond (double bond and triple bond) is considered as unsaturated.

b) State the **reactants and special conditions** that would be required to saturate beta carotene. **You do NOT need to draw the product for the reaction.** **(1)**

~~Elimination~~ Presence of H_2SO_4 and Δ (Heat) is required. 1

H_2 ~~Hydrogenation~~ is required

Condition is presence of Pt/Ni/Pd, high pressure and heat. 6

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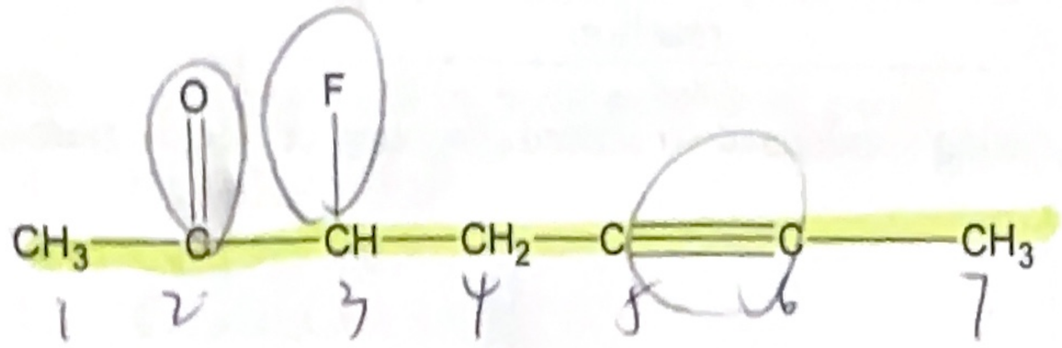
a b c d e f g h i j k l m n o p q r s t u

COMMUNICATION [7 marks]

12. Use proper IUPAC naming conventions to name the following structures. IF SPECIFIED also give the common name. *There are 7 marks available – you get up to one "free" error.*

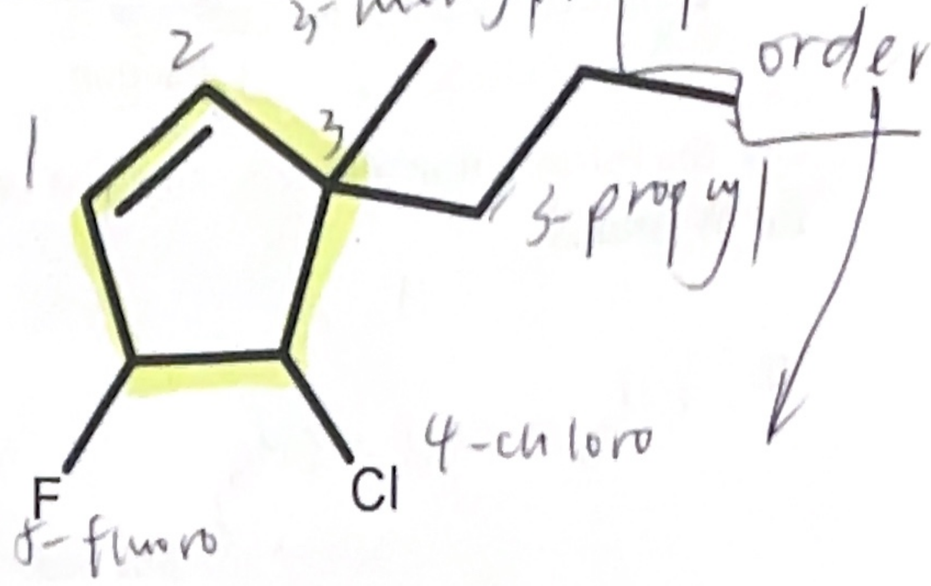
assume m goes before "f" in alphabetical order

(a)



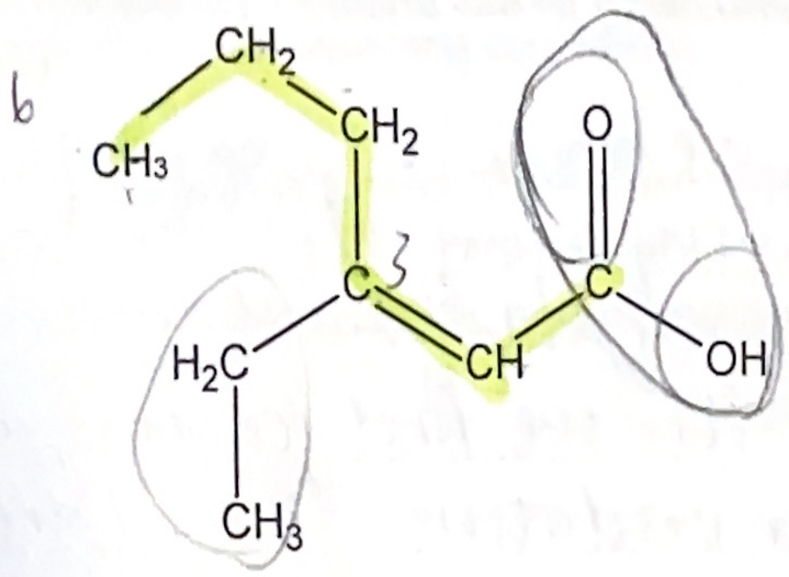
3-fluorohept-5-yn-2-one

(b) (6)



4-chloro-5-fluoro-3-methyl-3-propylcyclopent-1-ene

(c)



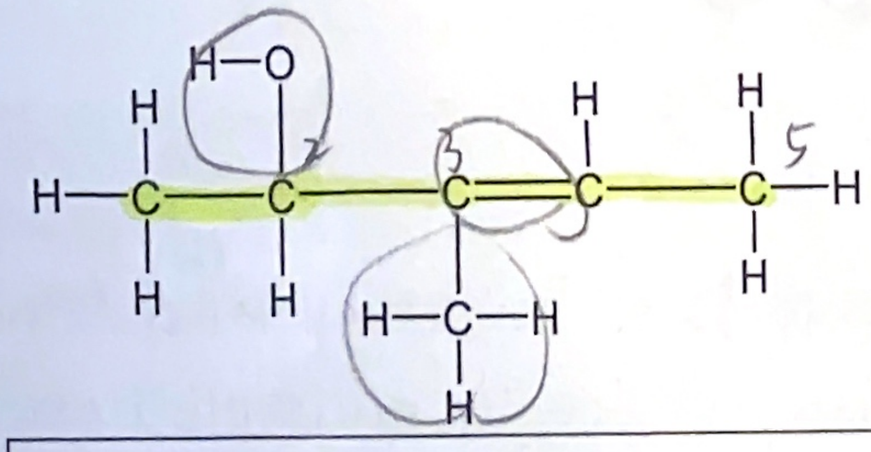
(d)

HOOCCOOH

i) IUPAC: ethanedioic acid.

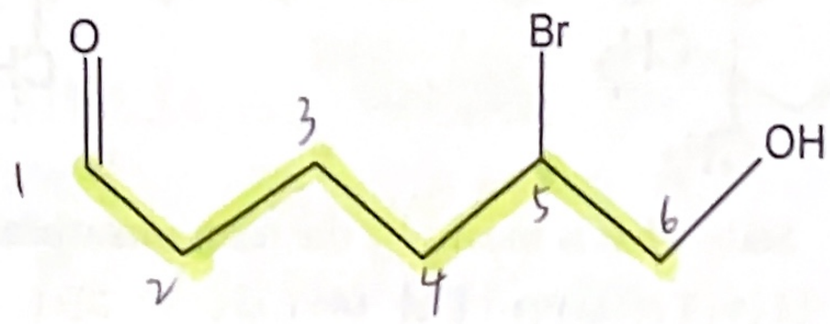
ii) Common: ~~oxally~~ oxalic acid

(e)



3-methylpent-3-en-2-ol

(f)



5-bromo-6-hydroxylhexanal

Correct types of diagram, showing work etc. _____ (1 mark)

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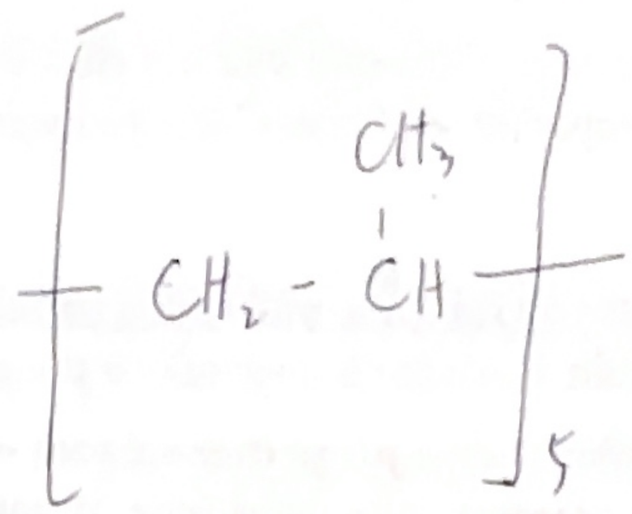
APPLICATION

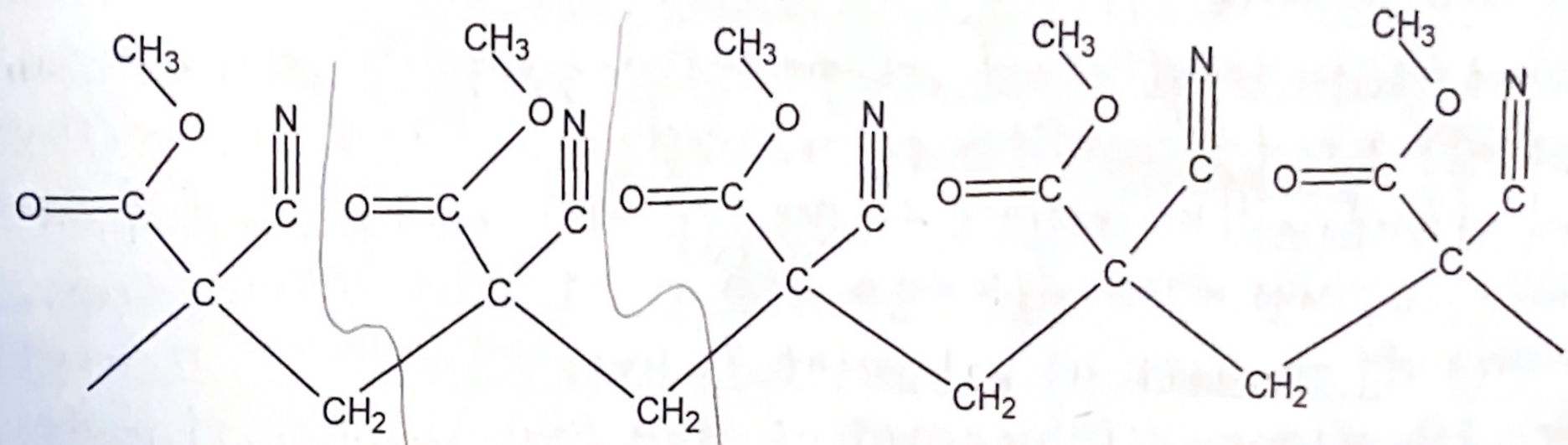
[10 marks]

13. a) Write the **polymer notation** for a section of **polypropylene** containing 5 monomers. (2)

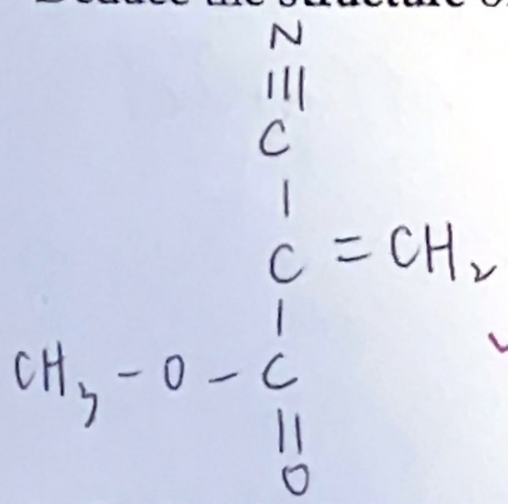


✓ 2

b) Cyanoacrylates are a group of monomers that polymerize to form superglues and other fast-drying, strong adhesives. Krazy Glue, a common superglue, is polyethyl cyanoacrylate. A section of Krazy Glue polymer is shown below



Deduce the **structure** of **the monomer** used to make Krazy Glue (2)



✓

addition = double bonds opens up
+
2 no by-product

c) Both polyethylcyanoacrylate and polypropylene are addition polymers because of the type of reaction used to create them. State the functional group that must be present in all addition polymers, and explain why the type of reaction is called an "addition" reaction. (2)

It is called an "addition" reaction as polymer addition requires double bond (or triple bond) to be opened up to bond with other repeating monomer. Multiple bond ~~is required~~ must be presented in all addition polymers.

1

d) Some polymers are flexible, and some are rigid. Explain how the rigidity of a polymer can be increased. (2)

The more cross linking between different polymer chain there are, the more rigid the polymers.

2

7

14. Two types of paint are used to paint walls of buildings – **latex paint and oil paint**. Latex paint contains **polar pigment (colour) particles** dissolved in water and oil paint contains **nonpolar pigment particles** dissolved in a nonpolar solvent. When the paint dries only the dry pigments are left on the wall.

If you paint latex paint over oil paint it will not stick (it will peel off when dry). To help you avoid this problem paint companies sell "tester" kits to determine whether the existing (dry) paint on your wall is oil or latex.

To use these tester kits you rub your wall with a pad that is wet with acetone (propanone) and see whether some of the old, dry paint comes off on the pad. polar

Using your understanding of the **properties of acetone (propanone) and those of the pigments in each of the types of paint**, state **what type of paint pigment would come off the wall** when tested and **explain why.**

(2)

Oil paint would come off the wall. As acetone is a polar ~~molecule~~ compound, due to its short chain length and ~~=O gro~~ ketone group. As polar ~~wall~~ substance would be attracted to another polar substance, since the partially charged end of one polar molecule will be attract to the oppositely charged end of another ~~other~~ polar molecule, thus, when rubbing ~~a polar~~ latex paint with acetone, acetone would not come off. However, as oil paint is non polar pigment, it would not interact with polar substance, acetone and thus, rubbing oil painted wall with acetone

Extra space for continuations or corrections

See attached.