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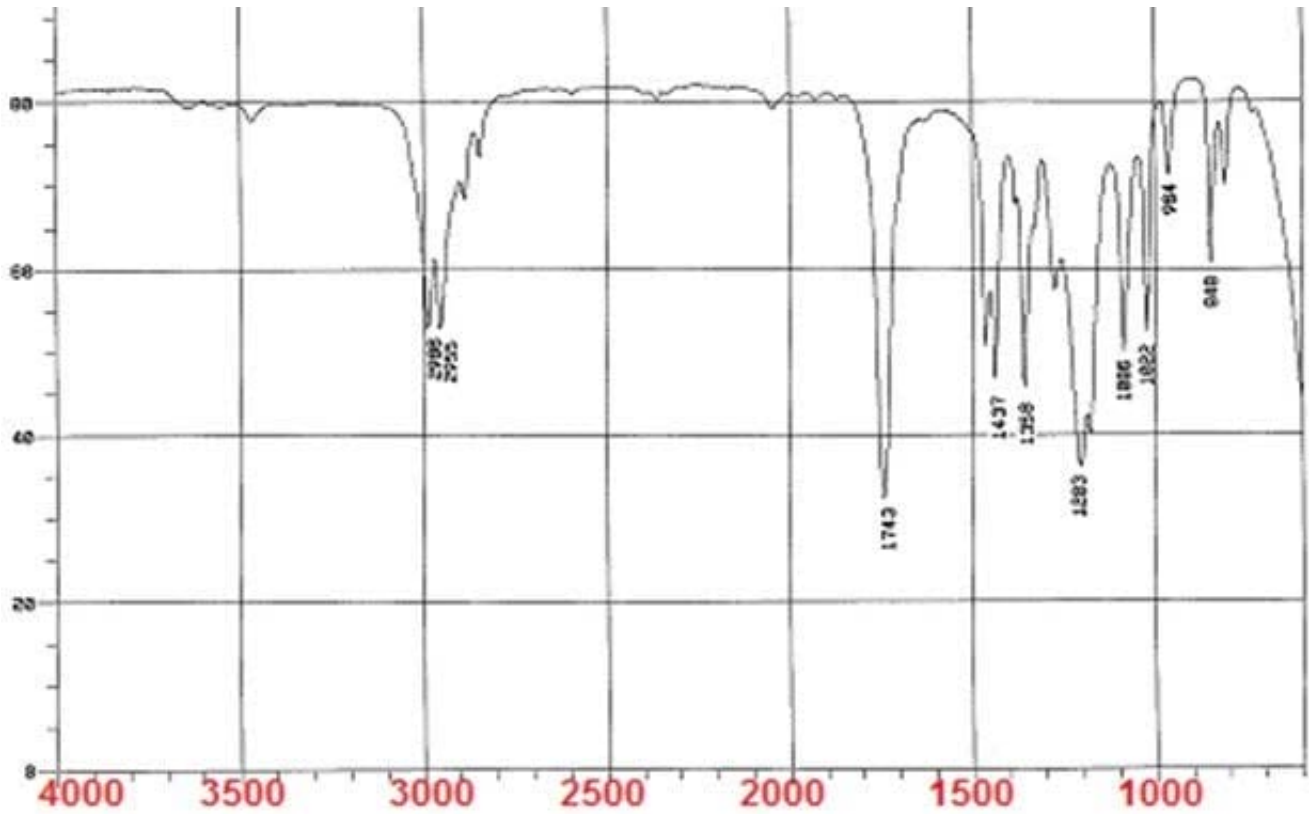
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QUESTION 1

Using the following infrared spectroscopy, determine the closest possible compound it may represent.



- A. c1ccccc1
- B. Oc1ccccc1
- C. CC(=O)CC(O)C
- D. CC(=O)OC
- E. CC(=C)OC

A. Option A



B. Option B

C. Option C

D. Option D

E. Option E

Correct Answer: D

The peak at 1700 indicates the presence of a carbonyl group. The bands from 3000-2800 indicate C-H alkane stretches. Finally, the bands from 1300-1000 correlate with an ester group. This narrows down the answer to D: methyl propanoate.

QUESTION 2

5 friends just got hired for a job. 4 of them will earn \$12 an hour, and the fifth person will earn \$3 more than the average of all five salaries. How much does the fifth person make?

A. \$13

B. \$13.75

C. \$14.25

D. \$15 E. \$15.75

Correct Answer: E

Solve this algebraically. Solve for x (amount fifth person gets paid). $x = [(4 \times 12) + x] / 5 + 3$
 $5x = 48 + x + 15$
 $5x = 63 + x$
 $4x = 63$
 $x = 15.75$

The 5th friend makes \$15.75. This can be confirmed by adding up all 5 people's pay and finding the average: $(12 + 12 + 12 + 12 + 15.75) / 5 = 12.75$.

\$15.75 is \$3 higher than the average of \$12.75

QUESTION 3

An optical system has a focal length 30 cm away from the mirror, and an object 5 cm farther out from the focal point. What is the distance of the image formed in this concave mirror?

A. 210 cm

B. 250 cm

C. 195 cm

D. 300 cm

E. 500 cm

Correct Answer: A



D_i = Image distance

D_o = Object distance

f = focal distance

$$(1 / f) = (1 / D_i) + (1 / D_o)$$

Rearrange to solve for D_i : $D_i = (1 / f) - (1 / D_o)$

$$(1 / D_i) = (1 / 30) - (1 / 35)$$

$$(1 / D_i) = 1 / 0.0048$$

Inverse both sides to get D_i : ~210 cm.

QUESTION 4

A spring is sitting in an equilibrium position. What would happen to the force of the spring if you pulled the spring to a length double of that of its equilibrium?

- A. Force would half
- B. Force would stay the same
- C. Force would double
- D. Force would quadruple
- E. Not enough information is provided

Correct Answer: C

$F = -kx$; where x = displacement from the equilibrium position Doubling the displacement (x) would double the force (F).

QUESTION 5

Hormones composed of steroids are synthesized in which of the following organelles in the cell?

- A. Smooth ER
- B. Rough ER
- C. Golgi apparatus
- D. Ribosomes
- E. Peroxisomes

Correct Answer: A

The smooth ER is responsible for synthesizing components of the plasma membrane along with lipids (steroids) such as testosterone that act as hormones in the body. It is critical to be familiar with the cell organelles and their function as it is



expected to be a question in the biology section.

QUESTION 6

What is the hydrostatic pressure in a pond at a depth of 100 m? (Density of water = 1000 kg/m³)

- A. 1.0×10^6 Pa
- B. 1.0×10^6 atm
- C. 1.0×10^5 Pa
- D. 1.0×10^5 atm
- E. 300 Pa

Correct Answer: A

Hydrostatic Pressure = ρD where:

= Density of fluid (1000 kg/m³ here, as given) ρ = Gravity (unless stated otherwise, this is 10 m/s²) D = Depth (100 m, as given)

Simply plug and chug. Remember the SI unit of pressure is Pascal (Pa). Since all given units are in their respective SI formats, no conversion is needed.

QUESTION 7

A square has a perimeter of x and an area of $2x$. What is x ?

- A. 8
- B. 16
- C. 20
- D. 24
- E. 32

Correct Answer: E

If a square has a perimeter of 32 (x), then its sides must be 8. The area is then: $8 \times 8 = 64$, or $2x$.

QUESTION 8

8 dogs must line up behind each other in single file to get a treat. How many different ways can the dogs line up?

- A. 8
- B. 16



- C. 64
- D. 320
- E. 40320

Correct Answer: E

This question is asking for the different ways the 8 dogs can be arranged, without repeats. This is represented by the factorial (!). Thus, $8! = 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 40320$. Thus, the number of ways to arrange the 8 equal dogs is 40320.

QUESTION 9

Which of the following relationships is an example of commensalism?

- A. Virus – Host cell
- B. Bacteria in intestines of humans
- C. Nitrogen-fixing bacteria in legumes
- D. Spider crab and algae
- E. Suckerfish and shark

Correct Answer: E

The sucker fish (also known as Remora) attaches to the shark and eats what the shark discards and gets protection at the same time, all while the shark doesn't get any benefit (nor harm) from this attachment.

The virus and host cell is a form of parasitism, and the other examples are all mutualism, where both organisms involved in the relationship benefit.

QUESTION 10

In which of the following stages of embryo development are the three primary germ layers first present?

- A. Blastula
- B. Zygote
- C. Gastrula
- D. Coelomate
- E. Morula

Correct Answer: C

The gastrula is formed from the blastocyst, which contains a bilayered embryonic disc. One layer of this disc's inner cell mass further subdivides into the epiblast and the hypoblast, resulting in the three primary germ layers (endoderm, mesoderm, ectoderm).

**QUESTION 11**

A titration of NaOH and HF is made. Which of the following equivalence points pH can be possible?

- A. 7.0
- B. 13.5
- C. 1.2
- D. 4.5
- E. 9.3

Correct Answer: E

The titration of a strong base with a weak acid produces a basic equivalence point. However, a basic equivalent point is not anything beyond 11 usually.

QUESTION 12

On a bad day, have you ever been irritable? Have you ever used a harsh tone or even been verbally disrespectful to your parents or teachers? Everyone has a short temper from time to time, but current statistics indicate that between 16% and 20% of a school population suffer from a psychological condition known as Oppositional Defiance Disorder, or ODD.

ODD symptoms include difficulty complying with adult requests, excessive arguments with adults, temper tantrums, difficulty accepting responsibility for actions, low frustration tolerance, and behaviors intended to annoy or upset adults. Parents of children with ODD can often feel as though their whole relationship is based on conflict after conflict.

Unfortunately, ODD can be caused by a number of factors. Some students affected by ODD suffer abuse, neglect, and severe or unpredictable discipline at home. Others have parents with mood disorders or have experienced family violence. Various types of therapy are helpful in treating ODD, and some drugs can treat particular symptoms. However, no single cure exists.

The best advice from professionals is directed toward parents. Therapists encourage parents to avoid situations that usually end in power struggles, to try not to feed into oppositional behavior by reacting emotionally, to praise positive behaviors, and to discourage negative behaviors with timeouts instead of harsh discipline.

According to the passage, which of the following is a cause of ODD?

- A. Poor diet
- B. Low IQ
- C. Excessive television viewing
- D. Severe or unpredictable punishment

Correct Answer: D



QUESTION 13

The coexistence of solid, liquid and gas in thermodynamic equilibrium is called:

- A. Melting point
- B. Triple point
- C. Condensation point
- D. Equilibrium point
- E. Coexisting point

Correct Answer: B

This is indeed the definition of what a triple point is.

QUESTION 14

PLASTICS

Plastics have long been considered one of the great conveniences of the modern era, but evidence is mounting to indicate that these conveniences have come at an incredible cost. The chief benefit of plastics is their durability, but this benefit turns out to be the same reason plastic has become a significant problem: It takes 200 to 400 years to decompose. All of this plastic has accumulated into a catastrophic mess and has also caused disease in humans.

Between Hawaii and Japan, a giant mass of plastic twice the size of Texas slowly swirls with the currents of the Pacific Ocean. This area has come to be known as the Great Pacific Garbage Patch, and its effects on the ecology of the ocean are unimaginable. According to United Nations researchers, a hundred thousand sea mammals and a million seabirds die each year. They are found with cigarette lighters, syringes, and other plastics that they mistake for food in their stomachs.

Evidence also indicates that the plastic receptacles that people store their food in poses health risks. For instance, phthalates have been shown to have detrimental effects on the reproductive system, yet they are found in many plastic products including baby bottles and water bottles. They have also been linked to various forms of cancer. Additionally, a chemical called bisphenol A that is found in many plastics can mimic the effects of the hormone estrogen, which can also affect the reproductive system.

Which of the following statements can be inferred from paragraph two?

- A. No one has determined why sea mammals and seabirds are dying at an alarming rate.
- B. The Great Pacific Garbage Patch is not a significant threat to humans.
- C. The Great Pacific Garbage Patch is too large to be cleaned up by one country.
- D. Ocean currents carry the plastic to the middle of the ocean.

Correct Answer: D

QUESTION 15



Given the following reaction, how might one shift the equilibrium to the left? $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$

- A. Add $\text{N}_2(\text{g})$
- B. Add helium
- C. Decrease the pressure
- D. Remove $\text{NH}_3(\text{g})$
- E. Decrease the volume

Correct Answer: C

Decreasing the pressure shifts the equilibrium towards the side with more moles of gas. The left side has 4 moles of gas whereas the products has 2 moles of gas, thus the equilibrium will shift to the left. Adding an inert gas will not affect the equilibrium. The other options will shift the equilibrium to the right.

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