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QUESTION 1

As Alice Echols went on to claim, "Nothing seems to conjure up the 1970s quite so effectively as disco. Even at the time, critics remarked upon disco's neat encapsulation of that decade's zeitgeist. It must be clear by now to everyone with an ear or an eye that this era," wrote journalist Andrew Kopkind in 1979, "is already the Disco Years, whether it will be called by that name or not." A former sixties radical, Kopkind was by turns fascinated, bemused, and appalled by the disco epoch, and he likely imagined that in years to come fellow cultural critics would share his interest. But the seventies have not loomed large in our national imagination, except perhaps as comic relief. For many Americans, these were the forgettable years.

That forgettability owes a lot to the 1960s, the outsized decade that dwarfs all others in recent memory. The sixties will always be remembered for their audacity, whether found in the courage of civil rights protesters who put their bodies on the line or in those doomed but beautiful rock stars who tried breaking through to the other side. By contrast, the seventies seem the decade when nothing, or nothing good, happened—an era memorable for the country's hapless presidents, declining prestige, bad fashions, ludicrous music, and such over-the-top narcissism that Tom Wolfe dubbed it the "Me Decade." Before the decade was out, this narrative of decline had become routine. "After the poetry of the Beatles comes the monotonous bass-pedal bombardment of Donna Summer," huffed one New York Times writer in 1979. It is a measure of the era's persistent bad press that a recent book challenging this view carries the pleading title *Something Happened*.

As for the sixties, it doesn't matter how much silliness went down, we still invest those times with seismic significance. Take Joe Cocker's performance at Woodstock. His spasmodic thrashing about and his vocals, slurred to the point of incomprehensibility, are something of a joke today. Cringe-inducing though it may be, however, Cocker's performance is never made to stand in for the whole of the sixties. The sixties remain enveloped in the gauzy sentimentalism of what might have been. Yet the iconic image of John Travolta as dance-floor king Tony Manero in white polyester suit, arm thrust to the disco heavens, has come to symbolize the narcissistic imbecility and inconsequentiality of the disco years.

Were it not for the Rubaiyat, I, too, might well regard the seventies as a lamentable and regrettable period in American history. The Rubaiyat was, yes, a disco. It was located in the heart of sixtiesland: Ann Arbor, Michigan, the home of the University of Michigan and legendary incubator of radical activism. At the height of the seventies, the town's annual Hash Bash—a smoke-in to reform marijuana laws—was still going strong and so were its two food co-ops—one reform, the other orthodox when it came to selling white foods (that is, rice, sugar, and flour of the white variety). Ann Arbor also had bookstores galore, including the original, wonderful Borders Bookstore, and any number of hippie-ish restaurants and bars such as the Fleetwood Diner, the Del Rio, and the Blind Pig. Musically, it prided itself on its vintage music (it hosted one of the earliest blues festivals), but at heart it was a rock town besotted with Iggy Pop and the Stooges and Sonic's Rendezvous, a band fronted by Patti Smith's future husband, Fred Smith. Its leading music store, Schoolkids Records, stocked disco, but never played it. All of this is to say that disco-averse Ann Arbor came close to providing something of a safe haven from glitterball culture.

The Rubaiyat was no red-velvet-rope disco where fashionista doormen determined who was sufficiently fabulous to gain entry. This would never have worked in a town where down jackets and army surplus were hardly an unusual sight. The club did have some pretensions to classiness, but the mismatched, sagging booths and bordello red defeated occasional efforts at upmarket sophistication. What the Rubaiyat did have were better-than-average speakers, a heterogeneous clientele, and a weekend cover of three dollars."

Echols, A. (2011). *Hot stuff: Disco and the Remaking of American Culture*. New York: W. W. Norton.

What is the author's main argument in this passage about the public perception of disco?

- A. The 70s were a time when people were becoming apathetic and shallow, so their music reflects this.
- B. Disco has been made to stand in for the perceived silliness of the era as a whole.
- C. While the music of the 70s had its foolish moments, the music and culture of the 60s have been overrated and were just as foolish.



D. Cultural critics in the 70s believed that their decade would become known as the "Disco Years," but they were proved wrong.

Correct Answer: B

This Foundations of Comprehension question is asking for the main idea in the passage's discussion of disco. The author begins by stating that disco was seen as a key component of 70s culture, and argues that "the seventies have not

loomed large in our national imagination, except perhaps as "comic relief," and adds that the image of Tony Manero dancing in Saturday Night Fever has come to stand in for the decade. Thus, the argument is that this era is seen as foolish,

and that disco is emblematic of that perceived foolishness.

A ?incorrect. The remark from a New York Times writer in 1979 does imply the senselessness and shallowness of the era as reflected by their music. However, the author herself does not argue that people during the 70s were becoming

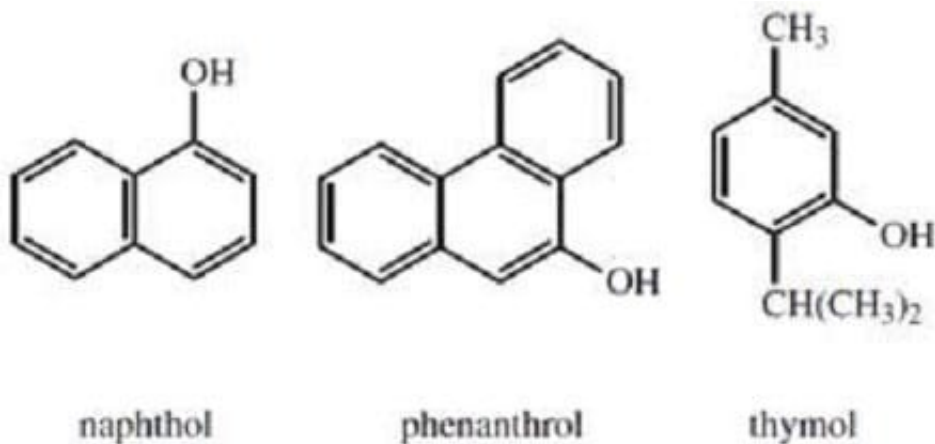
apathetic and shallow, but rather cites this as one of the popular views about the era. (Note: The ability to distinguish the author's argument from those of the other authors quoted in the passage is commonly tested in CARS.)

C ?incorrect. The author does argue in paragraph 3 that foolish moments in 60s popular culture have been overlooked, but this is not a main argument and she does not describe the 60s overall as overrated D ?incorrect. The author argues

that the 70s have received less attention that might have been expected, but that the association of them with disco has remained.

QUESTION 2

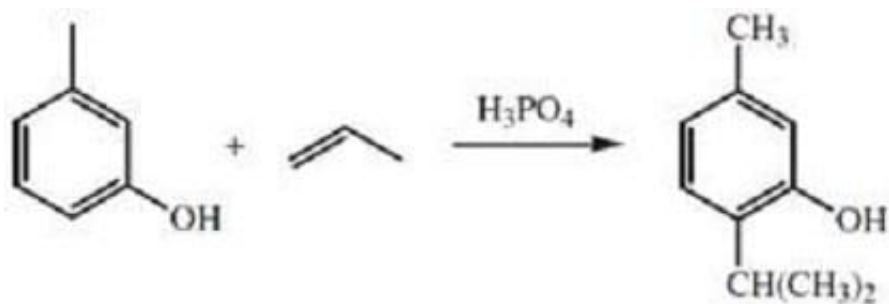
Compounds containing a hydroxyl group attached to a benzene ring are called phenols. Derivatives of phenols, such as naphthols and phenanthrols, have chemical properties similar to those of phenols, as do most of the many naturally-occurring substituted phenols. Like other alcohols, phenols have higher boiling points than hydrocarbons of similar molecular weight. Like carboxylic acids, phenols are more acidic than their alcohol counterparts. Phenols undergo a number of different reactions; both their hydroxyl groups and their benzene rings are highly reactive. A number of chemical tests can be used to distinguish phenols from alcohols and carboxylic acids.



Thymol, a naturally occurring phenol, is an effective disinfectant that is obtained from thyme oil. Thymol can also be synthesized from m-cresol, as shown in Reaction A below. Thymol can then be converted to menthol, another naturally-occurring organic compound; this conversion is shown in Reaction B.

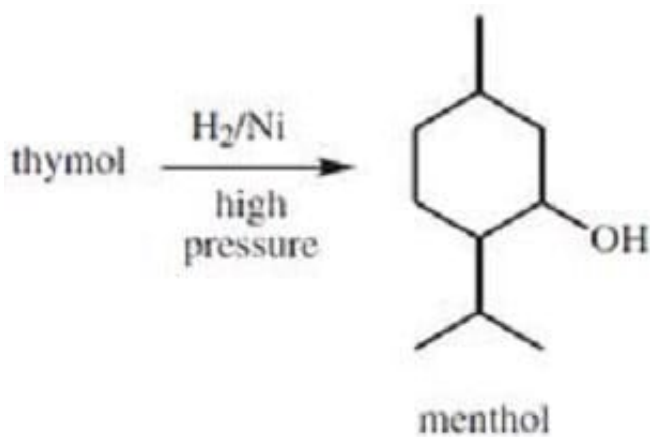


Reaction A

*m*-cresol

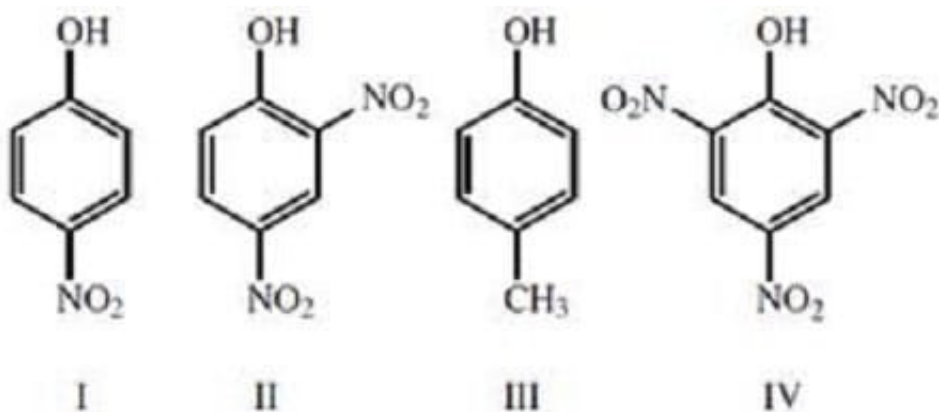
thymol

Reaction B



menthol

Which of the following shows the order of decreasing acidity among the four compounds below?



- A. I, III, IV, II
B. IV, I, II, III
C. IV, III, II, I
D. IV, II, I, III

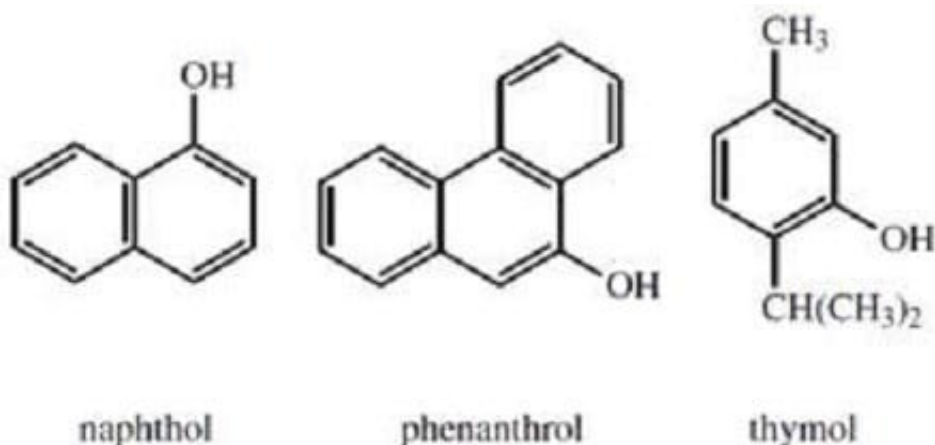


Correct Answer: D

In order to answer this question, you need to know what characteristics of a substituted phenol will tend to increase its acidity. The more electron-withdrawing groups a phenol has, the more any negative charge can be dispersed and stabilized by resonance. Since resonance stabilization stabilizes the phenoxide ion more than the phenol, increased resonance stabilization will make a phenol more acidic. Looking at the four phenols, three of them have varying numbers of nitro groups, which you should know are strongly electron-withdrawing, and the fourth has a methyl group, which is electron-donating and should have the opposite effect from the nitro groups. So trinitrophenol, roman numeral four, which has the most nitro groups, is the most acidic, followed by dinitrophenol, which is roman numeral two, then para-nitrophenol, which is roman numeral one and, finally, para-cresol, roman numeral three, with the methyl group.

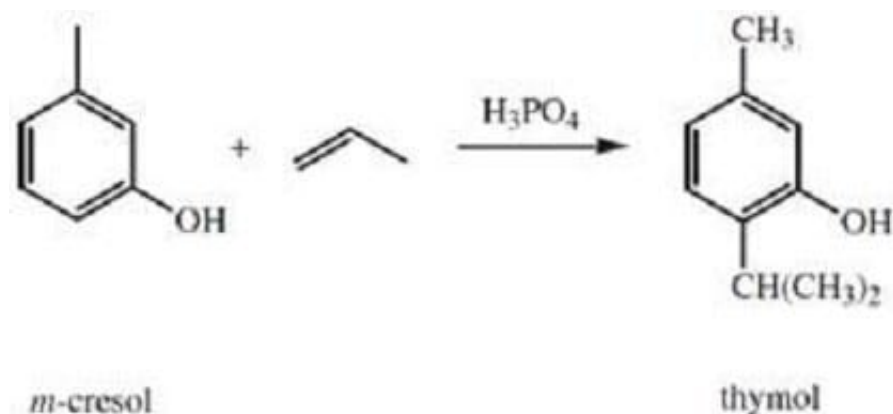
QUESTION 3

Compounds containing a hydroxyl group attached to a benzene ring are called phenols. Derivatives of phenols, such as naphthols and phenanthrols, have chemical properties similar to those of phenols, as do most of the many naturally-occurring substituted phenols. Like other alcohols, phenols have higher boiling points than hydrocarbons of similar molecular weight. Like carboxylic acids, phenols are more acidic than their alcohol counterparts. Phenols undergo a number of different reactions; both their hydroxyl groups and their benzene rings are highly reactive. A number of chemical tests can be used to distinguish phenols from alcohols and carboxylic acids.



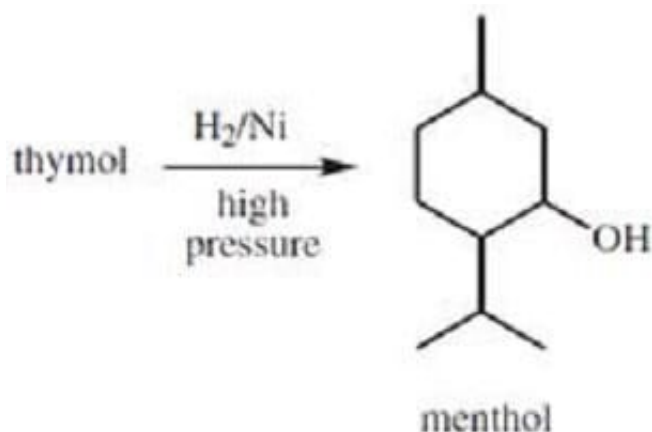
Thymol, a naturally occurring phenol, is an effective disinfectant that is obtained from thyme oil. Thymol can also be synthesized from *m*-cresol, as shown in Reaction A below. Thymol can then be converted to menthol, another naturally-occurring organic compound; this conversion is shown in Reaction B.

Reaction A





Reaction B



Reaction A is an example of:

- A. a free radical substitution.
- B. an electrophilic aromatic substitution.
- C. an electrophilic addition.
- D. a nucleophilic aromatic substitution.

Correct Answer: B

Reaction A is an electrophilic aromatic substitution reaction, in which thymol is formed from meta-cresol. Both the methyl and hydroxyl substituents in meta-cresol are ortho-para directing activators. However, hydroxyl is the more powerful of the two and if you look at reaction A you can see that substitution occurs ortho to the hydroxyl group. However, we are not too concerned about substituent effects but rather the mechanism of the reaction, so let's briefly review what happens. Initially, phosphoric acid abstracts an electron from propene creating a secondary carbocation. This carbocation then acts as an electrophile and adds to the electron rich benzene ring, ortho to the hydroxyl group. This results in the formation of an arenium ion and aromaticity is regained by loss of a proton, generating thymol. Therefore, this mechanism is electrophilic aromatic substitution -- making choice B the correct answer. From this mechanism, it should be pretty easy to eliminate the other answer choices. Choice C is wrong, because although the carbocation adds to the ring, a proton is lost in order to regain aromaticity. Therefore, this is an example of substitution NOT addition. Choice D is wrong because the carbocation which adds to the ring is acting as an electrophile, not a nucleophile. Remember that benzene is electron rich, and the substituents on meta-cresol enhance this, so there is no way that meta-cresol could be susceptible to nucleophilic attack. Finally, choice A -- free radical substitution -- is also wrong. There is nothing in reaction A to suggest that free radicals are formed and phosphoric acid will not induce radical formation.

QUESTION 4

Apoptosis is the process of programmed cell death that can occur in multicellular organisms. The proteins involved in apoptosis are associated with pathways for cell cycle arrest and DNA repair. These processes are mostly regulated through the interplay of various proteins involved in feedback loops including some of the ones shown in Figure 1.

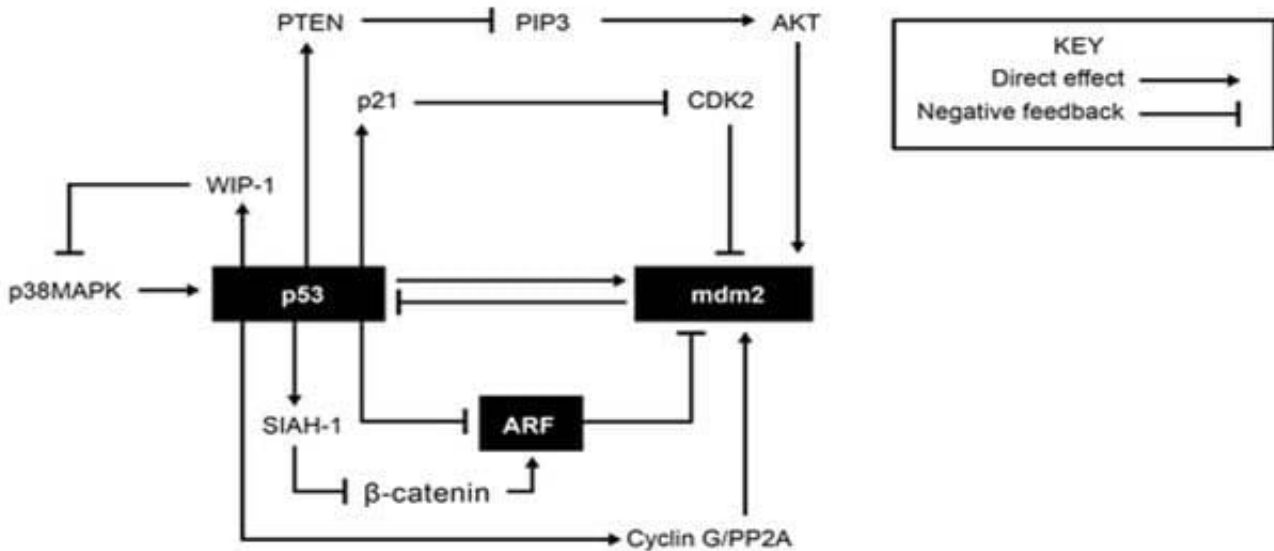


Figure 1: Feedback loops forming a regulatory network affecting apoptosis, cell cycle arrest and DNA repair. (Bioinformatics Institute) According to Figure 1, CDK2 activity would most reasonably increase due to all of the following EXCEPT:

- A. degradation of p21.
- B. high cyclin G concentrations.
- C. a mutation in the gene that produces PTEN.
- D. high p53 concentrations.

Correct Answer: D

Notice the key in the figure which will allow us to follow each arrow that stimulates the next protein and each symbol for negative feedback which means there will be some downregulation (amount/concentration goes down). [Notice a key step in the diagram: p21 inhibits CDK2]

Degradation of p21 implies that the concentration of p21 in its active form goes down. The diagram shows that p21 has a negative influence on CDK2. In other words, when p21 is high, CDK2 goes low. But in our instance, p21 is low (degraded) so this allows CDK2 to rise unchecked.

High cyclin G concentrations: From the bottom of Figure 1, we can see that high cyclin G leads to high mdm2 and low p53 (notice carefully, when we leave mdm2, there is only one place to go in the diagram because all the other symbols are pointing to mdm2 and only one symbol is pointing away). Note that we used the most direct route to get to CDK2 as the question used the words "most reasonably". Low p53 means low p21 which we established will lead to a rise in CDK2.

A mutation in the gene that produces PTEN: The great majority of mutations will result in an ineffective gene product or none at all. Thus we have a decrease in PTEN which will lead to a rise in PIP3 (if you are unsure, think of what happens if PTEN goes up, then PIP3 must go down because of the negative feedback symbol), rise in AKT, rise in mdm2, decrease in p53 which we already established means an eventual rise in CDK2.

High p53 concentrations: clearly we get the opposite of the above, meaning a decrease in CDK2. High p53 stimulates p21 which has a negative feedback on CDK2.



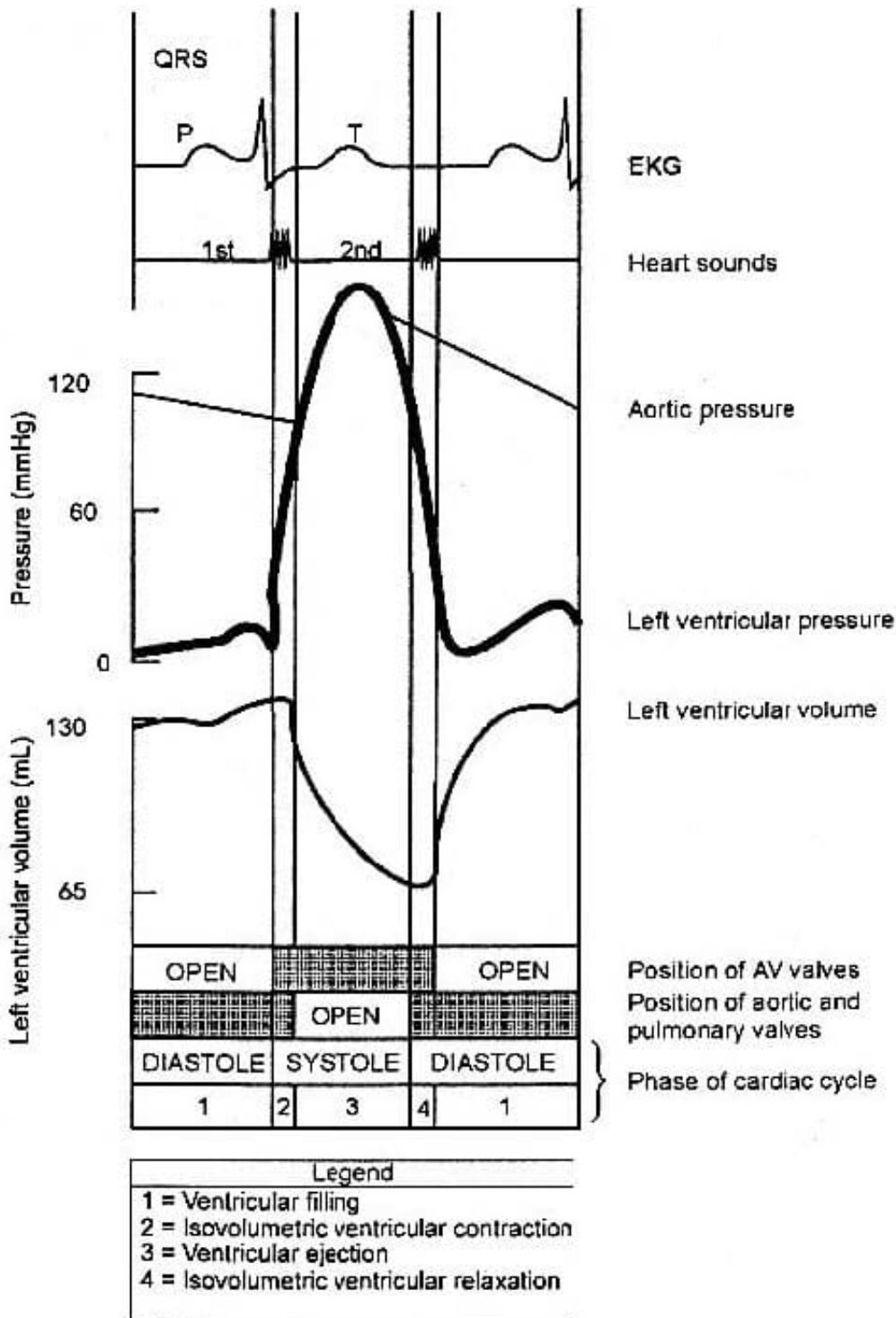
QUESTION 5

The process of depolarization triggers the cardiac cycle. The electronics of the cycle can be monitored by an electrocardiogram (EKG). The cycle is divided into two major phases, both named for events in the ventricle: the period of ventricular contraction and blood ejection, systole, followed by the period of ventricular relaxation and blood filling, diastole.

During the very first part of systole, the ventricles are contracting but all valves in the heart are closed thus no blood can be ejected. Once the rising pressure in the ventricles becomes great enough to open the aortic and pulmonary valves, the ventricular ejection or systole occurs. Blood is forced into the aorta and pulmonary trunk as the contracting ventricular muscle fibers shorten. The volume of blood ejected from a ventricle during systole is termed stroke volume.

During the very first part of diastole, the ventricles begin to relax, and the aortic and pulmonary valves close. No blood is entering or leaving the ventricles since once again all the valves are closed. Once ventricular pressure falls below atrial pressure, the atrioventricular (AV) valves open. Atrial contraction occurs towards the end of diastole, after most of the ventricular filling has taken place. The ventricle receives blood throughout most of diastole, not just when the atrium contracts.

Figure 1: Electronic and pressure changes in the heart and aorta during the cardiac cycle.



Position P on the EKG of Fig. 1 probably correspond to:

- A. atrial contraction.
- B. ventricular contraction.
- C. the beginning of ventricular systole.
- D. the beginning of ventricular diastole.



Correct Answer: A

This question requires you to incorporate information from the figure with information given in the passage. Following vertically down from position P in Figure 1, note that it occurs during a period of diastole. In paragraph 3, sentence 4, the passage gives information concerning the actions of the heart during diastole which would lead to answer choice A. Alternatively, the answer can be deduced through information in the passage and figure. In paragraph 1, sentence 2, diastole is described as a period of ventricular relaxation, ruling out answer choice B. Position P in Figure 1 occurs during a period of diastole and it occurs at a point about halfway through that period, ruling out answer choices C and D.

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