MCAT-TEST Q&As

Medical College Admission Test: Verbal Reasoning, Biological Sciences, Physical Sciences, Writing Sample

Pass MCAT MCAT-TEST Exam with 100% Guarantee

Free Download Real Questions & Answers **PDF** and **VCE** file from:

https://www.passapply.com/mcat-test.html

100% Passing Guarantee
100% Money Back Assurance

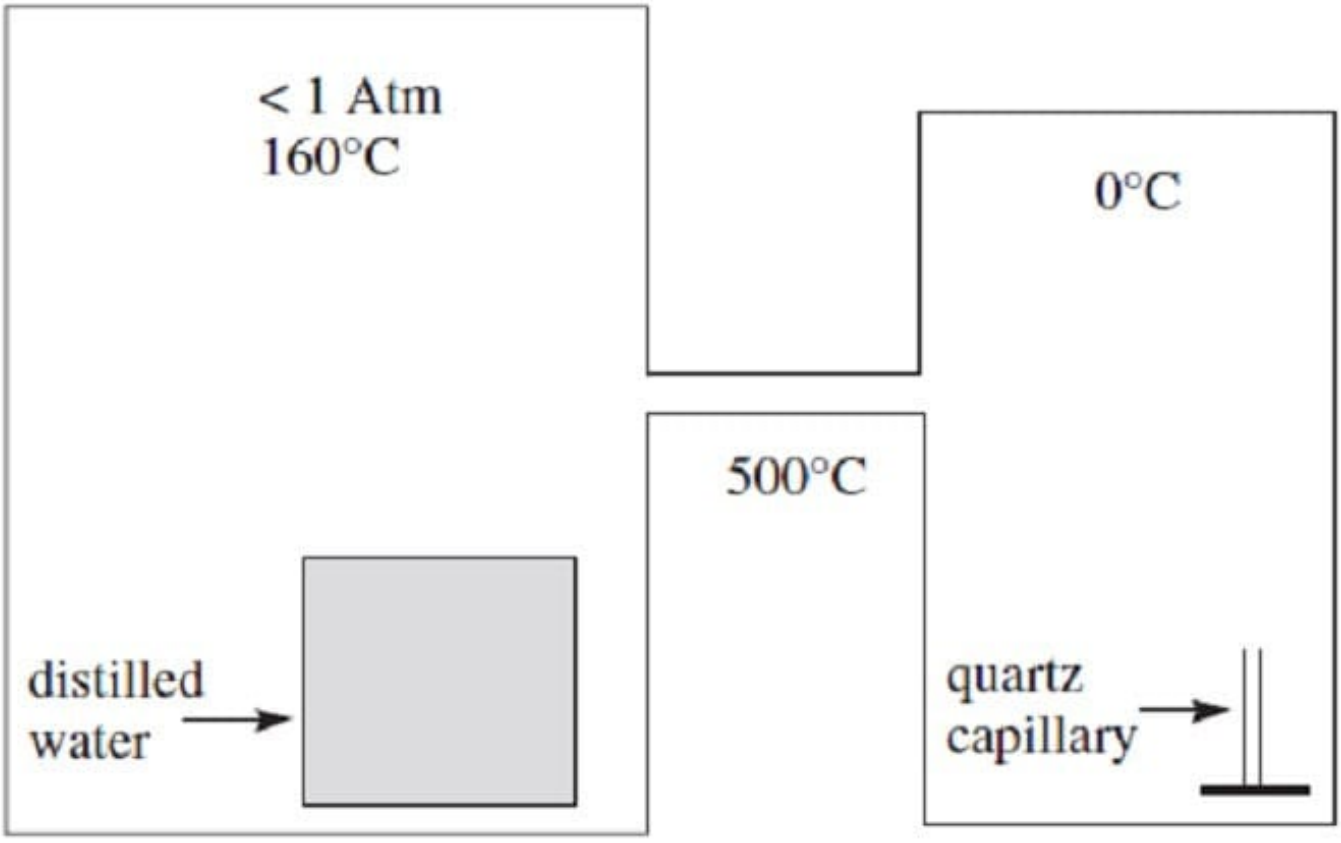
Following Questions and Answers are all new published by MCAT Official Exam Center

- **Instant Download** After Purchase
- **100% Money Back** Guarantee
- **365 Days** Free Update
- **800,000+** Satisfied Customers

QUESTION 1

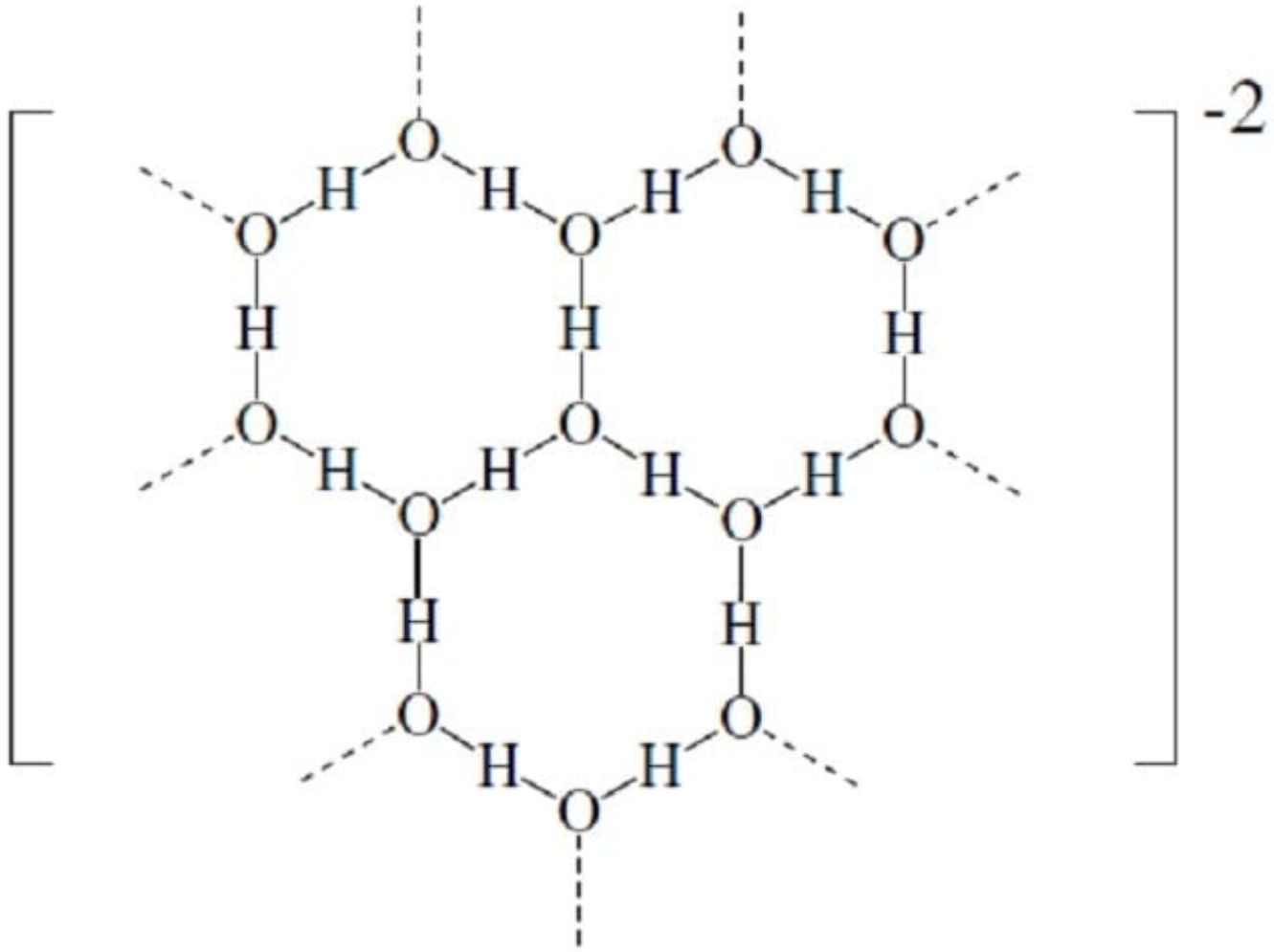
In 1965, Boris Deryagin reported the discovery of an unusual substance formed during the condensation of water vapor in quartz capillaries. The material, called poly-water, appeared to be a polymer of water monomers and differed from normal water in a number of ways. It had a freezing point of ?0?C and solidified into a glass-like solid with substantially less volumetric expansion than that of ordinary water upon freezing. It had a density 40% greater than water and a refractive index of 1.48.

An intricate apparatus was used to produce the poly-water. Ordinary distilled water was placed in a chamber held at 160?C with pressure below atmospheric pressure. This chamber was connected to a second chamber by a tube held at 500?C in order to prevent the passage of liquid water. The second chamber was held at 0?C and contained a drawn quartz capillary in which the water vapor condensed, forming poly-water.



Hypothesis 1

Deryagin proposed that polywater was a polymer of water monomers arranged in a network of hexagonal units. The polymerization was catalyzed by the silicate surface of the quartz capillary.



Proposed Structure of Polywater Hypothesis 2

$(Na^+$ and $Cl^-)$.

Another researcher was skeptical. Analysis indicated that polywater was merely a solution of water and dissolved particles including silicon, carbon dioxide, and substantial concentrations of ions These contaminants dissolved from the quartz capillary and from materials used in the apparatus.

k_f

m^2

(constants for normal water : density = 1 g/c , index of refraction = 1.33 , freezing point depression constant = 1.86°C)

Which of the following changes in the experimental apparatus would increase the rate of water vapor production in the first chamber of the experimental apparatus? (All other conditions kept constant.)

A. Decreasing the temperature

B. Decreasing the pressure

C. Decreasing the cross-sectional area of the tube connecting the two chambers

D. Adding NaCl to the distilled water in the first chamber

Correct Answer: B

Decreasing the pressure would increase the water vapor production. Looking at the equilibrium below, it is clear that reduction of pressure would favor the formation of gas by Le Chatelier\\'s principle.

$$H_2O(l) + \text{heat} \rightleftharpoons H_2O(g)$$

Choice A is incorrect. Decreasing the temperature would decrease water vapor production. Note that adding heat to the equilibrium shown above would drive the reaction to the right. Conversely, removing heat would drive the reaction to the

left.

Choice C is incorrect because decreasing the cross-sectional area of the tube, if anything, would slow down the rate of vapor production because the vapor would not escape the first chamber as rapidly.

Choice D is incorrect because increasing the solute concentration of the water would tend to decrease the vapor pressure.

QUESTION 2

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 cliente, and a weekend cover of three dollars."

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

The author most closely means which of the following in paragraph 2 by "narrative of decline"?

A. A work of history that focuses on a period when culture was becoming more stagnant, such as the 60s- 70s.

B. A version of 20th century history in which 60s idealism, peace and progress gave way to 70s crime, violence and racism.

C. A version of history in which an author fits the facts into an overarching schema in which things were becoming dramatically worse.

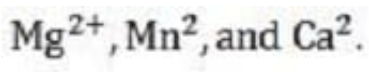
D. A version of 20th century history that claims the 60s was a failure because its ambitions were not fulfilled.

Correct Answer: C

This Reasoning Within the Text question is asking you to make sense of a phrase the author does not fully explain. In the surrounding text, the author writes that "The sixties will always be remembered for their audacity... 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." She then quotes a critic unfavorably comparing the Beatles to Donna Summer. Thus, the author is saying that when authors compare the 60s and 70s, they choose details that make the latter decade seem much worse, fitting this 10-year time period into a story in which culture is stagnant ?and even in decline, at some points in the narrative. A ?incorrect. The author does not argue that culture was actually becoming stagnant in the 60s-70s, but that only the 70s was portrayed and remembered with negative overtones. B ?incorrect. The passage does not argue that the 70s was portrayed as a violent or turbulent time, but as a time of stagnation when "nothing happened," and "decline" was occurring. D ?incorrect. The author argues elsewhere that commentators see the 60s in an idealized way based on "what might have been," not that they were a failure altogether.

QUESTION 3

Many nutrients required by plants exist in soil as basic cations:



A soil\\'s cation-exchange capacity is a measure of its ability to adsorb these basic cations as well as exchangeable hydrogen and aluminum ions. The cation-exchange capacity of soil is derived from two sources: small clay particles called micelles consisting of alternating layers of alumina and silica crystals, and organic colloids.

$A1^{3+}$

Replacement of + and + by other cations of lower valence creates a net negative charge within the inner layers of the micelles. This is called the soil\\'s permanent charge. For example, replacement of an atom of aluminum by calcium within a section where the net charge was previously zero, as shown below, produces a net charge of ?, to which other cations can become adsorbed.

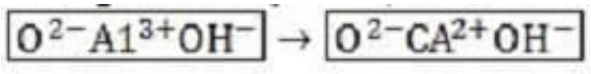


Figure 1

A pH-dependent charge develops when hydrogen dissociates from hydroxyl moieties on the outer surfaces of the clay micelles. This leaves negatively-charged oxygen atoms to which basic cations may adsorb. Likewise, a large pH-

dependent charge develops when hydrogen dissociates from carboxylic acids and phenols in organic matter.

In most clays, permanent charges brought about by substitution account for anywhere from half to nearly all of the total cation-exchange capacity. Soils very high in organic matter contain primarily pH-dependent charges. In a research study,

three samples of soil were leached with a 1 N solution of neutral KCl, and the displaced A13+ and basic cations measured. The sample was then leached again with a buffered solution of BaCl2 and triethanolamine at pH 8.2, and the

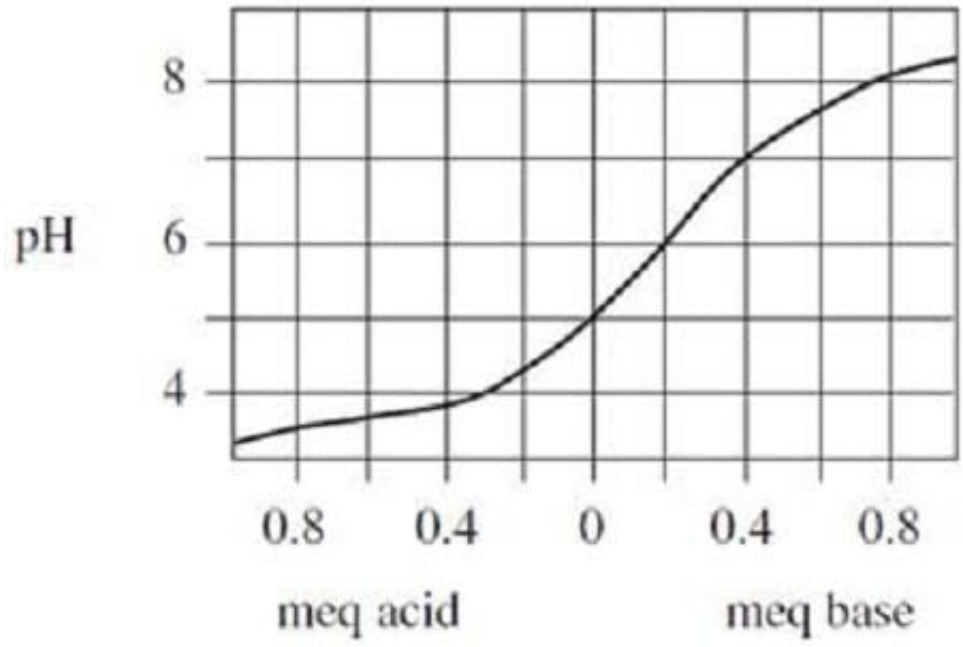
displaced H+ measured. Table 1 gives results for three soils tested by this method.

Table 1

	(meq/100 g)				Total Cation Exchange Capacity
	pH	Al^{3+}	Basic Cations	H^+	
Sample I	4.5	11.7	1.9	34.0	47.6
Sample II	5.3	1.6	16.3	19.5	37.4
Sample III	6.0	0.5	9.8	7.8	18.1

Due to the buffering effect of the soil\\'s cationexchange capacity, just measuring the soil solution\\'s pH will not indicate how much base is needed to change the soil pH. In another experiment, measured amounts of acid and base were added to 10-gram samples of well-mixed soil that had been collected from various locations in a field. The volumes of the samples were equalized by adding water. The results were recorded in Figure 2.

Figure 2.



What percentage of the cation exchange capacity of Sample I is base-saturated?

A. 4%

B. 6%

C. 29%

D. 40%

Correct Answer: A

The percentage base saturation consists of the number of milliequivalents of basic ions divided by the entire cation exchange capacity of the soil. For Sample I, that is the third column in Table 1 divided by the fifth, or 1.9 divided by 47.6. If you multiply 1.9/47.6 by 2/2, you can estimate this ratio to be approximately 4/96, which is about 4%, choice A.

QUESTION 4

Four major blood types exist in the human ABO blood system: types A, B, AB, and O; and there are three alleles that code for them. The A and B alleles are codominant, and the O allele is recessive. Blood types are derived from the presence of specific polysaccharide antigens that lie on the outer surface of the red blood cell membrane. The A allele codes for the production of the A antigen; the B allele codes for the production of the B antigen; the O allele does not code for any antigen. While there are many other antigens found on red blood cell membranes, the second most important antigen is the Rh antigen. Rh is an autosomally dominant trait coded for by 2 alleles. If this antigen is present, an individual is Rh+; if it is absent, an individual is Rh-. For example, a person with type AB blood with the Rh antigen is said to be AB+.

These antigens become most important when an individual comes into contact with foreign blood. Because of the presence of naturally occurring substances that closely mimic the A and B antigens, individuals who do not have these antigens on their red blood cells will form antibodies against them. This is inconsequential until situations such as blood transfusion, organ transplant, or pregnancy occur.

Erythroblastosis fetalis is a condition in which the red blood cells of an Rh+ fetus are attached by antibodies produced

by its Rh- mother. Unlike ABO incompatibility, in which there are naturally occurring antibodies to foreign antigens, the Rh system requires prior sensitization to the Rh antigen before antibodies are produced. This sensitization usually occurs during the delivery of an Rh+ baby. So while the first baby will not be harmed, any further Rh+ fetuses are at risk.

The Coombs tests provide a method for determining whether a mother has mounted an immune response again her baby\\'s blood. The tests are based on whether or not agglutination occurs when Coombs reagent is added to a sample. Coombs reagent contains antibodies against the anti-Rh antibodies produced by the mother. The indirect Coombs test takes the mother\\'s serum, which contains her antibodies but no red blood cells, and mixes it with Rh+ red blood cells. Coombs reagent is then added. If agglutination occurs, the test is positive, and the mother must be producing anti-Rh antibodies. The direct Coombs test mixes the baby\\'s red blood cells with Coombs reagent. If agglutination occurs, the test is positive, and the baby\\'s red blood cells must have been attacked by its mother\\'s anti-Rh antibodies. In a paternity case, the mother has type A+ blood and her son has type O- blood. If the husband has type B+ blood, which of the following is true?

A. The husband could be the father.

B. The husband could not be the father.

C. The husband could not be the father of a son, but could be the father of a daughter.

D. The husband is definitely the father.

Correct Answer: A

Let\\'s determine as much as we can about the blood types of the parents and the son. We know that the mother is blood type A positive, and therefore one of her alleles codes for the A antigen. We don\\'t know whether the other allele for that locus is an O or A. The mother is also Rh positive, and again, similar reasoning applies here. We know that she has at least one Rh allele that codes for the Rh antigen, which makes her Rh positive, since the Rh allele is dominant. We don\\'t know about the second allele at that locus; it might be either Rh positive of Rh negative. Let\\'s take a look at the son. The son is O negative, so here we know his genotype precisely. His genotype for the ABO blood groups is OO. Likewise, with respect to the Rh locus, he\\'s doubly negative. If he had just one Rh allele he would be Rh positive, since the allele is dominant. So the son\\'s genotype must be OO Rh negative Rh negative. Working backwards, we can deduce that his mother\\'s genotype must be AO Rh positive Rh negative, since the son inherited one allele per locus from his mother. Let\\'s take a look at the husband. The husband is type B positive, so we know that he has to have at least one B allele and one Rh allele. In the paternity case the question to be addressed is, is it possible for the husband to be the father of this boy, knowing what we know about the mother? The answer is yes, it\\'s possible. We know that the mother\\'s genotype is AO Rh positive, Rh negative; now suppose that the husband\\'s blood type is BO Rh positive Rh negative. If this were the case, then the son could have inherited one O allele from each parent and one Rh negative allele from each parent. Therefore, it is possible for these two people to conceive an O negative child. thus, the correct answer is choice A; the husband could have been the father. We can\\'t answer D, that the husband was definitely the father, because we just don\\'t know; maybe the mother had an affair with another man whose blood type contained both the O allele and the Rh negative allele. From our discussion, choices B and C are obviously incorrect. And besides, the gender of the child has no influence whatsoever on blood type.

QUESTION 5

A continuous spectrum of light, sometimes called blackbody radiation, is emitted from a region of the Sun called the photosphere. Although the continuous spectrum contains light of all wavelengths, the intensity of the emitted light is much greater at some wavelengths than at others. The relationship between the most intense wavelength of blackbody radiation and the temperature of the emitting body is given by Wien\\'s law, ? = 2.9 x 106 /T, where ? is the wavelength in nanometers and T is the temperature in kelvins.

As the blackbody radiation from the Sun passes through the cooler gases in the Sun\\'s atmosphere, some of the photons are absorbed by the atoms in these gases. A photon will be absorbed if it has just enough energy to excite an

electron from a lower energy state to a higher one. The absorbed photon will have an energy equal to the energy difference between these two states. The energy of a photon is given by E = hf = hc/? where h = 6.63 x 10-34 J•s, Planck\\'s constant, and c = 3 x 108 m/s, the speed of light in a vacuum.

The Sun is composed primarily of hydrogen. Electron transitions in the hydrogen atom from energy state n = 2 to higher energy states are listed below along with the energy of the absorbed photon:

Final Energy State Energy (x 10-19 J) n = 3

3.02

n = 4

4.08

n = 5

4.57 n = 6

4.84

n = ?

5.44

If the temperature of the Sun\\'s photosphere is 5800 K, what wavelength of radiation does the Sun emit with the greatest intensity?

A. 2 nm

B. 50 nm

C. 500 nm

D. 4,500 nm

Correct Answer: C