

# FREE Gamsat Practice Questions



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## FREE Gamsat Practice Questions

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For those of you who don't know me, I'm Dr Peter Griffiths and I sat Gamsat in 2005 so I know exactly what you're going through!

Back when I sat Gamsat there were virtually no preparation materials for the test except Des O'Neills question banks (that company has now closed) and a couple of other companies selling expensive courses for the science.

I was the first person to systematically analyse the test, categorise the types of questions asked in all the sections, propose a syllabus for section 3 and try to get behind ACER's essay marking algorithm for section 2.

Before my career in medicine, I worked as a professional educator for many years in adult education, preparing students for exams and designing and teaching exam courses.

It was this knowledge which I applied to achieve success for myself in the test.

I don't have a first degree in science, and spent less than 4 months studying science before taking the test but I achieved a score which put me in the **top 10%**.

Being in the top 20% will normally **guarantee** you an interview.

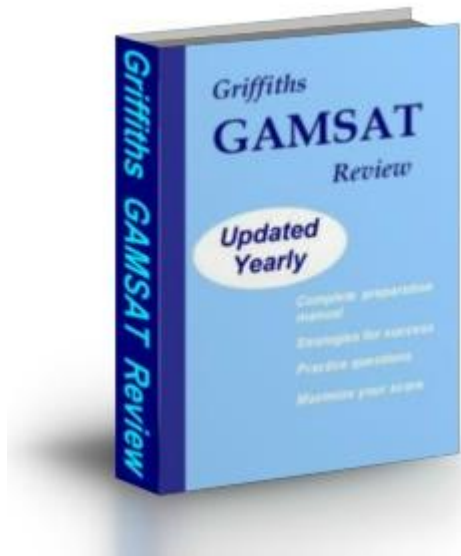
In my book [Griffiths Gamsat Review](#) I explain in detail what I discovered about the test and the strategies and methods I used to achieve my result. I hope it will help you to gain your own place at medical school.

On my website you can also get a full length [Practice Test](#) with fully worked answers.

I wish you the very best of luck !

*Dr Griffiths*

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Dr Peter Griffiths

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Please note that these questions are additional to the questions included in the Practice Test sold on my website and those included in Griffiths Gamsat Review and are not repeated in those books should you purchase them.

## Unit 1

Questions 1 and 2 are based on the passage below adapted from Greg Laden's Blog, "Why the Efe won't normally kill an insect"<sup>1</sup>.

The local culture is very uptight about babies and fertility issues generally. Some of this is spill over from the village-dwelling horticultural Lese with whom the foraging Efe share a culture. The Lese have a repressed fertility owing to a number of causes. When a fertility rule is broken, a great deal of effort may be expended to fix it. As the reproductive ecologist Peter Ellison once said, "The Lese and Efe are constantly afraid of overdrawing on the bank of fertility." One of the most dangerous things you can do is to accidentally have twins. That's like going to an ATM machine to get 100 bucks and the machine gives you 200 bucks. What do you do with the extra money? Will you get caught? When you check your bank account later, will there be 100 or 200 bucks taken out? Will there be a fee? A fine?

An insect that you don't know about might be an insect linked to something important like fertility, or if not fertility, something else. Better to just leave it alone and let it go on its own way.

The Efe do not generally look at beliefs of other people with disdain. Rather, they figure that those beliefs might be valid as well, and try to incorporate them in their routine.

So it makes sense that Efe would assume that an insect they've never seen before ... and in this very species rich rain forest that is not as unlikely as it sounds, though it is certainly not a daily occurrence ... has an importance of which they are simply unaware.

1 Efe concerns about fertility issues most likely derive from

- A low fertility rates in the Efe.
- B cultural attitudes about having twins.
- C low fertility rates amongst the Lese.
- D the killing of insects.

2 The Efe belief system could best be described as

- A reactionary.
- B accommodating.
- C superstitious.
- D primitive.

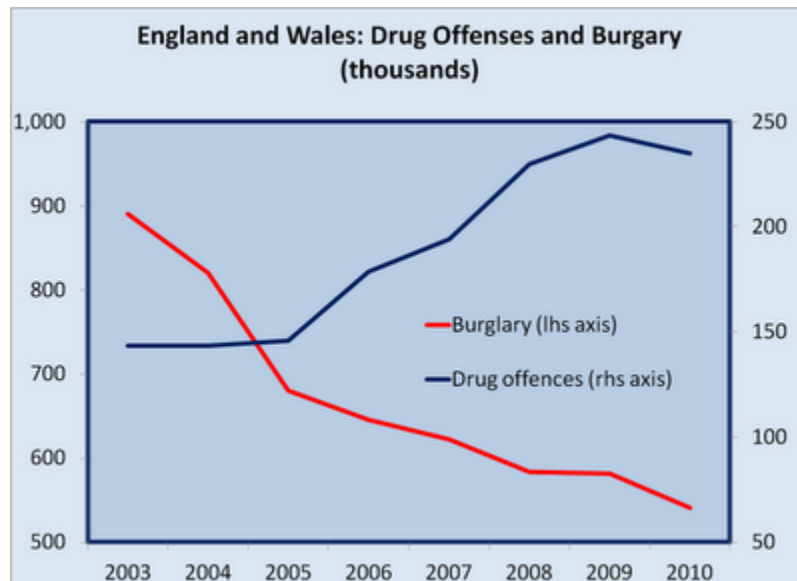
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<sup>1</sup> [http://scienceblogs.com/gregladen/2011/08/the\\_reason\\_the\\_efewont\\_normal.php](http://scienceblogs.com/gregladen/2011/08/the_reason_the_efewont_normal.php)

## Unit 2

Question 3 is based on the graphic depicting the number of burglaries and drug offenses between 2003 and 2010 and a short passage that follows.

Drug offences go up, burglary goes down<sup>2</sup>



The prevailing myth is that drug use is associated with crime and the drug user's speciality is burglary. "If only drugs were legal, users wouldn't have to commit crime, especially burglary".

The data, however, doesn't want to sing that song. Since 2003, drug offences exploded. At the same time, burglary offences fell.

There are a couple of ways to explain the paradox presented by the data:

- Target the drug offence, tackle the crime - Perhaps the data is telling us that the Police should target drug offences. Finding an addict with a few crumbs of Class A heroin is easier than catching him breaking and entering.
- Misreporting - Crime data has become totally politicised. The police have a strong incentive to register declines in key crime categories.
- Lower drug prices reduce crime - Another possibility is that lower prices of drugs reduce the need to commit crime. Previously, it might have taken two criminal offences to secure a given amount of drugs; now it only takes one.

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<sup>2</sup> [http://ukhousebubble.blogspot.com/2010\\_12\\_01\\_archive.html](http://ukhousebubble.blogspot.com/2010_12_01_archive.html)



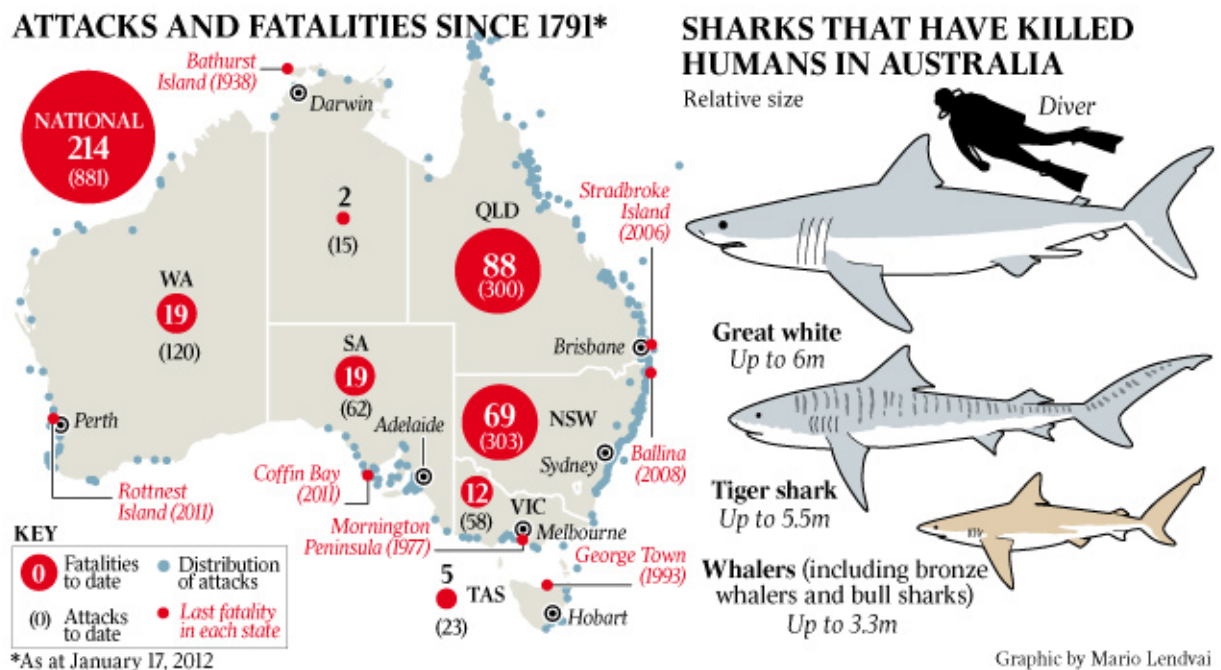
Personally, I like the first explanation, but that might be because of my deep rooted antipathy to drug takers.

3 The data presented in the graphic clearly shows that

- A Drug prices began dropping in 2003, reaching their lowest point in 2010.
- B Drug addicts are easier to catch than burglars, so police should target drug crimes.
- C There is no correlation between the data on burglaries and drug use.
- D Root causes behind the data can likely be found by examining policy and trends in early 2005.

### Unit 3

Question 4 is based on Graham Lloyd's article "Half-truths and great white lies" depicting Australian shark attacks between 1791 and January 17, 2012, and a short passage that follows<sup>3</sup>.



JUST north of Redhead Beach near Newcastle, NSW, where a 44-year-old surfer this week became the latest victim of a seemingly endless summer of shark-attack fear, is one of the few known nursery areas for endangered great whites.

<sup>3</sup> From: The Australian, January 20, 2012 12:00AM



It is a hot spot for the juvenile "man-eaters", the dangers of which have been seared into public consciousness by Steven Spielberg's Hollywood blockbuster "Jaws".

And despite the high numbers of sharks in the area and the fact that popular swimming beaches are located within the juvenile great white zone there has never been a reported great white attack in the area.

Consider the statements below and answer the question that follows.

- I Great whites are not responsible for the recent attack on a 44-year-old surfer near Redhead Beach in Newcastle, NSW.
  - II Great white sharks are more likely to attack humans than are tiger sharks and whalers due to their size.
  - III On rare occasions shark attacks occur out of the ocean.
  - IV The media has exaggerated the likelihood of great white shark attacks.
  - V People are able to identify the kind of shark that attacked them with a high level of accuracy.
- 4 Which of the statements above is supported by the graphic and/or passage?
- A Statements I and II
  - B Statements II and IV
  - C Statements I, III, and V.
  - D Statements III, IV and IV.

#### UNIT 4

Question 5 is based on the passage below adapted from "Four Mistaken Goals of Children"<sup>4</sup>. Why does six-year-old Mikie keep banging his foot against the table leg at dinner? Most likely, Mikie has no idea why he keeps doing it. But there is a reason.

"Stop banging the table leg, Mikie," mother said, annoyed. Mikie stopped momentarily but began again. Mother again scolded, and Mikie stopped again for a minute, but soon resumed his behaviour.

Mother reached over and cuffed her son upside the head and yelled, "I said stop that! You're driving me crazy. Why can't you sit quietly and eat?"

Because Mikie's behaviour is producing results, he realizes that he has power and that he can win. From this exercise, we can conclude that Mikie wants his mother to notice him and give

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<sup>4</sup> <http://high-desert-design.com/rwilliams/mission1.htm>

him her attention. Once his mother is aware of this she can redirect her attention and change the course of Mikie's behaviour.

By paying attention to children's positive behaviours, such as playing quietly, and putting toys away, parents train them towards what Adler called the "useful side of life." By having his annoying behaviours ignored, Mikie will discover that he isn't getting any response and not achieving his goal. Eventually, he will stop these behaviours and tend to perform (move toward) those behaviours that please his mother.

5 The passage suggests that

- A children typically prefer positive over negative attention.
- B Mikie's behaviour is purposeful, even if Mikey doesn't know the purpose.
- C children who receive adequate attention do not misbehave.
- D Mikie's behaviour is the result of his mother's poor parenting skills.

## UNIT 5

Questions 6 to 9 are based on the passage below adapted from the Nature News article "Malaria surge feared"<sup>5</sup> and five reader comments that follow.

Malaria is one of the world's most deadly diseases, each year killing about 880,000 people, mostly children in sub-Saharan Africa, according to the World Health Organization.

In many African countries, as well as India and North Korea, DDT is sprayed inside homes and buildings to kill mosquitoes that carry malaria.

The scientists reported that DDT may have a variety of human health effects, including reduced fertility, genital birth defects, breast cancer, diabetes and damage to developing brains. Its metabolite, DDE, can block male hormones.

"Based on recent studies, we conclude that humans are exposed to DDT and DDE, that indoor residual spraying can result in substantial exposure and that DDT may pose a risk for human populations," the scientists wrote in their consensus statement, published online today in the journal *Environmental Health Perspectives*.

"This is a global issue," Eskenazi said. "We need to enforce the Stockholm Convention and to have a plan for each country to phase out DDT, and if they feel they can't, good reason why other options cannot work."

Mexico, the rest of Central America and parts of Africa have combated malaria without DDT by using alternative methods, such as controlling stagnant ponds where mosquitoes breed and using

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<sup>5</sup> <http://www.nature.com/news/malaria-surge-feared-1.10643>

bed nets treated with pyrethroid insecticides. But such efforts have been less successful in other places, particularly South Africa.

"We have a whole host of mosquito species and more than one parasite. The biology of the vectors is different and there is therefore no one-method-fits-all strategy, as is the case in Central America," Bouwman, world renown mosquito researcher, said. "For example", he said, "some types of mosquitoes in South Africa breed in running water, which cannot be easily controlled".

"The area to be covered is also vast, and infrastructure in most areas is too little to allow environmental management on a sustainable basis without DDT," he said.

6 Scientists investigating effects of DDT on humans

- A support strict enforcement of the world-wide ban on DDT.
- B recommend that DDT be phased out completely.
- C recognize that DDT may be the only solution in certain circumstances.
- D claim that the risks of using DDT outweigh the benefits.

Questions 7 to 9

### **Comment 1**

The pure hypocrisy of these American eco-colonialists makes me livid. Imagine these western elites telling Africans how to deal with malaria! One-million or more Africans--mainly women and infants--die of malaria each and every year--and this "panel's" advice: don't use DDT! Why? Because of "reduced fertility" and "breast cancer." The alleged linkage of breast (or any other cancer) and DDT has been sought and not found for over a decade. DDT was banned by the EPA administration in 1972 against the advice of the scientific advisory panel. There remains no evidence of significant adverse human health effects, which was true even at the massive overuse levels of the 1960s. Their "concern" over the "potential effects of DDT use on future generations" would be obviated by the loss of these generations to malaria without DDT.

Leave Africa to the Africans, and let's reduce the frightful toll of malaria in Africa with indoor spraying of DDT. And meanwhile, let us ask ourselves a very important question, why did we ban only DDT after we wiped out malaria in the US and Europe?

### **Comment II**

I am really shocked and enraged to find that DDT is back - of course it is harmful to humans, and everyone else. Those who support the use of DDT do so in contravention of a body of research that clearly demonstrates significant health risks associated with DDT. What does all this clamour to reinstate DDT do to further the development of inoculations? Are proponents of DDT unable to see that to eliminate malaria we must move forward, not backwards?

### Comment III

Let's see... 880,000 people, mostly children, a year suffering and dying vs. a possible increased risk of low sperm count? The list of possible side effects is not unlike bis-phenol A. The most effective solution to prevent over half a million child deaths a year should be denied for fear of a Statistically questionable group of non-acute symptoms?

### Comment IV

Using a simple and inexpensive solution of 28% Sodium Chlorite ( $\text{NaClO}_2$ ) and organic acids such as lemon or lime juice, or 5% acid vinegar (15 drops  $\text{NaClO}_2$  to 1/2 teaspoon acid), Dr E. Bodsworth creates Chlorine Dioxide to which he adds 4 ounces of apple juice or water. The concoction is then ingested. With just one dose, blood tests have proven the total elimination of Malaria from the body. After eliminating the malaria, the Chlorine Dioxide breaks down to a minute amount of salt and water with no harmful side effects, no poisons, and no toxins. So why isn't this being promoted more by world health agencies? Uh, let's see; maybe it is more profitable to do endless research to produce vaccines. I wonder who has the monopoly on DDT!

### Comment V

Africa is a vast continent. Even if DDT has little adverse effect on humans, it would need to be sprayed in colossal quantities which could have significant effects on biodiversity. Perhaps the best solution is to improve the quality of life of Africans, so that they could afford repellents and mosquito nets.

- 7 The author of comment III minimalises the
- A effects of malaria.
  - B effects of DDT.
  - C effects of bis-phenol.
  - D value of DDT research.
- 8 According the author of Comment II, which of the following is not a reason malaria remains a serious and persistent problem?
- A People do not know about Chlorine Dioxide.
  - B Cures are withheld to justify malaria research.
  - C A vaccine for malaria will never be developed.
  - D World health agencies are causing malaria to spread.
- 9 Taken as a whole, the passage and comments suggest that malaria
- A is the number one killer of poor people in sub-Sahara Africa.
  - B is a socio-economic and political problem as well a health issue.
  - C was prevalent around the globe before the introduction of DDT.
  - D can be eradicated if return to using DDT intensively but short term.

## Unit 6

Question 10 is based on the Theodore Roethke's poem "The waking"<sup>6</sup> and a table defining the four most common forms of irony in literature that follows.

### The Waking

I wake to sleep, and take my waking slow.  
I feel my fate in what I cannot fear.  
I learn by going where I have to go.  
We think by feeling. What is there to know?  
I hear my being dance from ear to ear.  
I wake to sleep, and take my waking slow.  
Of those so close beside me, which are you?  
God bless the Ground! I shall walk softly there,  
And learn by going where I have to go.  
Light takes the Tree; but who can tell us how?  
The lowly worm climbs up a winding stair;  
I wake to sleep, and take my waking slow.  
Great Nature has another thing to do  
To you and me, so take the lively air,  
And, lovely, learn by going where to go.  
This shaking keeps me steady. I should know.  
What falls away is always. And is near.  
I wake to sleep, and take my waking slow.  
I learn by going where I have to go.

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<sup>6</sup> <http://gawow.com/roethke/poems/104.html#top>

<b>Verbal Irony</b>	<b>Dramatic Irony</b>
This form of irony arises from the contrast between what is said and what is meant. At its simplest we know verbal irony as sarcasm. In its more subtle forms verbal irony may take the form of a metaphor.	This is the contrast between what the character thinks to be true and what we (the readers) know to be true. Dramatic tension arises from the fact that the reader knows more about the unfolding dramatic situation than the character does.
Irony here derives from the contrast between what is and what seems to be.	Irony here derives from the contrast between what is and what ought to be.
<b>Tragic Irony</b>	<b>Situational Irony:</b>
This is a form of dramatic irony in which a character becomes a victim of disaster because he or she misunderstands the situation or underestimates the challenge or foe, while the spectator or reader is aware of the truth of the situation and feels anxiety on the character's behalf.	This is the contrast between what happens and what is expected (or what would seem appropriate). Because it emerges from the events and circumstances of a story it is often more subtle and effective than verbal, tragic or dramatic irony.
Irony here derives from the difference between what is and what one wishes to be.	Irony here derives from the contrast between what is and what one expects to be.

- 10 Which of the four types of irony defined above is the dominant irony underlying Roethke's poem?
- A verbal irony
  - B dramatic irony
  - C tragic irony
  - D situational irony

## ANSWERS 1-10

1 There is no indication from the passage that the Efe suffer from low fertility rates, so option A must be eliminated. Option B is a symptom or outcome of the Efe and Lese concerns about fertility issues, not the cause of that concern, so it too must be eliminated. Option C, however, is supported. The passage tells us that the Lese, not the Efe have a repressed fertility which gives rises to a number of concerns and taboos. The Efe concern with fertility, the second sentence tells us, is "spill-over" from the Lese people with whom the Efe share a culture. Option D, like option B is the result or effect of Efe concerns about fertility, not a cause, so it too must be eliminated. Option C is clearly the correct answer.  
(C)

2 Faced with several seemingly relevant options, candidates must look for the answer that is best supported by the passage. To do this, they must discriminate between what they may think

of Efe beliefs and rely on the clues the author provides. If the Efe respect and go so far as to try to adapt the beliefs of others, they certainly are not reactionary (option A); they embrace rather than reject change. Nor should we refer to their beliefs' as being superstitious (option C) or primitive (option D). The author does not pass such judgements, so neither should candidates. The Efe respect and incorporate the beliefs of others into their routines. They are in short, highly accommodating of the beliefs of others, making option B the correct answer.

(B)

3 Candidates must take care here not to confuse what the data says and what the author speculates. He suggests that a drop in the price of drugs may have resulted in the need for fewer burglaries and that this, in turn, resulted in fewer burglary arrests (option A), but this is sheer speculation on the part of the author, not something the data tells us. Furthermore, we note that the numbers of arrests for burglaries began increasing in mid-2005, not in 2003 as suggested in option A. The author also speculates that it is easier to catch drug addicts than burglars, but, again, the data does speak to this possibility, and option B can be eliminated. Option C may or may not be true. We cannot tell from the data alone if there is a causal relationship between drug and burglary arrests or not. Option D is supported. Looking at the data presented in the chart we see that the trend in drug and burglary arrests reversed itself early in 2005. Understanding what happened by examining relevant factors including the political milieu, the cost of drugs, and any policy or political changes in 2005 could likely explain why burglary arrests suddenly and dramatically declined while drug arrests increase at just as suddenly and dramatically.

(D)

4 Statement I is supported. Although he was attacked in a great white shark nursery area where great white juveniles are known to be present in great numbers, the passage tells us there has never been a great white shark attack in the area. We can thus infer that the 44-year-old-surfer was not attacked by a great white shark. Statement II, however, is not supported. The graphic does depict the relative size of a human diver and the various sharks mentioned, but there is no suggestion that great whites are more likely than tiger sharks or whalers to attack humans because of their size. Statement III is supported by the graphic where we see dots indicating shark attacks on land (most likely near river mouths) and definitely away from the ocean. The media is mentioned, but Statement IV is not supported. The movie "Jaws" has inspired fear of great whites but it has not exaggerated the likelihood (odds) of great white shark attacks. Statement V, like statements I and III, is supported. As the author can definitively say that none of the attacks near the great white nursery have been carried out by great white sharks, we can infer that people who are attacked are able to identify the sharks that attack them with a great deal of accuracy. As statements I, III, and V are supported, option C is the correct answer.

(C)

5 The passage suggests that children prefer negative attention over no attention, but we cannot tell if children prefer negative over positive attention. Option A, then, is not supported. The passage does, however, support option B. Whether or not Mikie understands his motives, his aim is to get his mother's attention; his behaviour is purposeful even if Mikie doesn't know the purpose. Option C is not adequately supported. We can see that children must be trained towards the "useful side of life", but certainly, nothing in the passage suggests that children who receive ample positive attention will never misbehave as stated in option C. Option D is not supported.



Although we could classify Mikie's mother's parenting skills as "poor" we cannot tell whether Mikie would try to gain attention with negative behaviour if they were better.

(B)

6 Scientists include world renowned mosquito researcher Bouwman who recognizes that the mosquito reduction strategies and toxins that worked in Central America and parts of Africa are not universally applicable. From his statements we can see that DDT is needed still in extreme circumstances. Options A and B can be eliminated, then, as at least some part of the scientific community supports the use of DDT in some circumstances (option C). Option D can be eliminated as Bouwman tells us the opposite; in some circumstances the benefits outweigh the risks.

(C)

7 The author of Comment III adds the word "suffering" to the fatality statistics (880,000 people, mostly children, suffer and die" rather than simply telling us, as the passage does, that an estimated 880,000 people a year die). S/he also reminds us malaria kills mostly children for greater emotional effect. We cannot say, then, that the author minimalises the effects of malaria (option A). The author does, however, minimise the effects of DDT (option B) reducing them to a "possible increased risk of low sperm count". Because the passage does not elaborate on bisphenol we cannot tell for certain if the author of Comment II minimalises the effects of bisphenol. Option D is vague and not clearly supported by the passage. However, even though the author minimalises the effects of DDT s/he does not seem to underestimate or undervalue malarial research.

(B)

8 Candidates must take care here to look for the option that is NOT supported by the passage. The fact that author introduces Chlorine Dioxide and gives the receipt for this simple malaria cure, suggests that people don't know about it. Option A is supported by the passage so cannot be the correct answer. Option B is also supported. The author states research is profitable, and a simple, inexpensive cure would curtail funding for vaccine research; this clearly implies that cures are not promoted because researchers promote their own best interests. The author also calls this research "endless" from which candidates can infer a vaccine will never be developed as stated in option C – also supported so also incorrect. However, the author does not go so far as to state that world health agencies are responsible for the spread of malaria. As option D is NOT supported, it is the correct answer.

(D)

9 Option A can be eliminated quickly as neither the passage nor the comments tell how malaria ranks in comparison to other diseases. Comment I tells us that DDT was not banned until after malaria was eradicated in Europe and the US, but we cannot infer from this that it was once a globally prevalent, so option C is not adequately supported. Option D calls for knowledge not presented in the passage or comments, and as we have no way of telling if intense, short-term use of DDT could eradicate malaria where conditions are toughest, it too must be eliminated. That leaves option B, which is supported. Whether in favour of or against the use of DDT the passage and the comments all make it clear that DDT is an inexpensive option for countries that can't afford anything better; thus DDT is a socio-economic issue. The 1972 worldwide ban on DDT

supports that it is also a political issue. Furthermore, Comment I tells us to leave Africa (and malaria) to Africans, while Comment V tells us that the way forward is to improve the income and living standards for Africans. Option B, then, is clearly well supported while the remainder are not.

(B)

10 To determine the type of irony underlying Roethke's poem it is requisite that candidates understand the poem on a whole. Although the literal subject of the poem is "waking", the implied subject is life (walking/going), death (sleeping) and the poet's understanding of the two and resulting transcendence to a higher level of consciousness (waking) that gives him a greater understanding and appreciation of life. Although we tend to consider death as threatening and foreboding, here death is described in organic terms as part of the ever-mysterious life-death-rebirth cycle ("light takes the tree but who can tell us how?"). The "waking" described, is not physical, but metaphysical (having to do with our understanding of the spiritual or unseen world). Sleep is often equated with death, and here by sleeping, the persona familiarizes himself with death to the extent he accepts rather than dreads it. ("I feel my fate in what I cannot fear.") Freed of the fear of death yet aware of the transience of life the persona more fully appreciates life and his place in it; thus he "takes his walking slow" and learns the meaning of his life by living it ("I learn by going where I have to go.") Not everyone gains this awareness and joins the ranks of those who truly live as is implied when the persona asks his companion "Of those so close beside me, which are you?" (I.e. the living or the dead, the cognoscenti or the uninformed?) Rather than knowing less than the reader about his situation, the persona is aware of this paradox (situational irony) of life, so we can eliminate options B and C which both state the persona is unaware of the underlying irony of his or her situation. Option A can also be eliminated. Despite the reference to metaphor which brings poetry to mind automatically, the persona is sincere and there is no indication words are being used ironically for sarcastic effect. Metaphor is employed in the poem to communicate the ironic nature of life and death and, by implication, what the persona knows about this paradoxical situation. The poem, then, is based on situational irony.

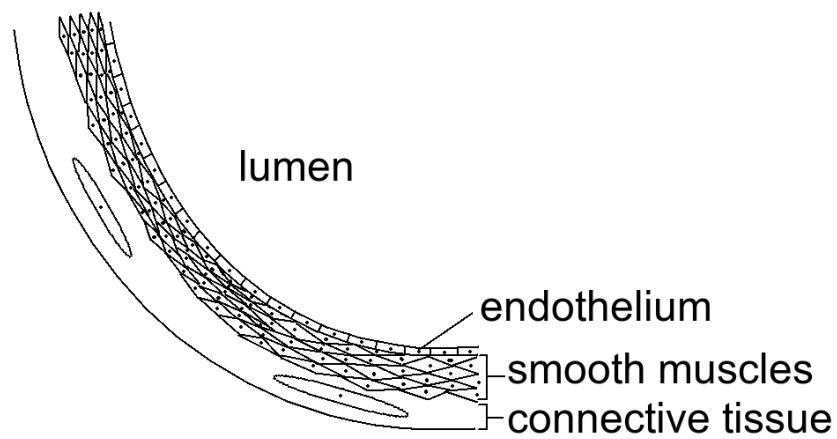
(D)

## **Sample Questions Section 3**

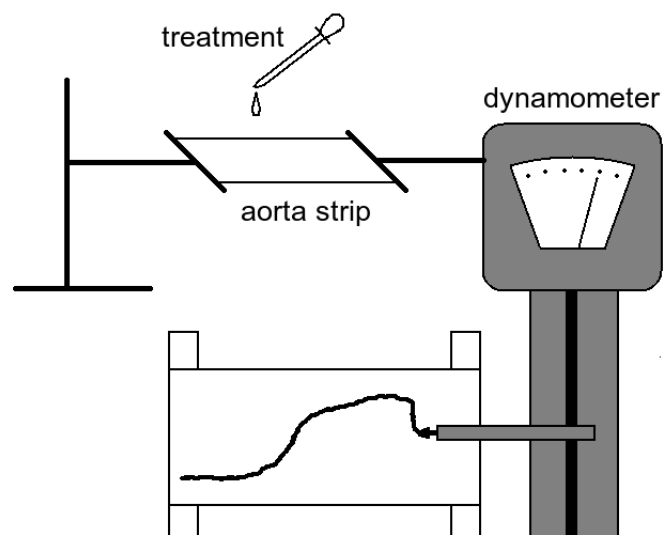
## Unit 1

### Questions 1-2

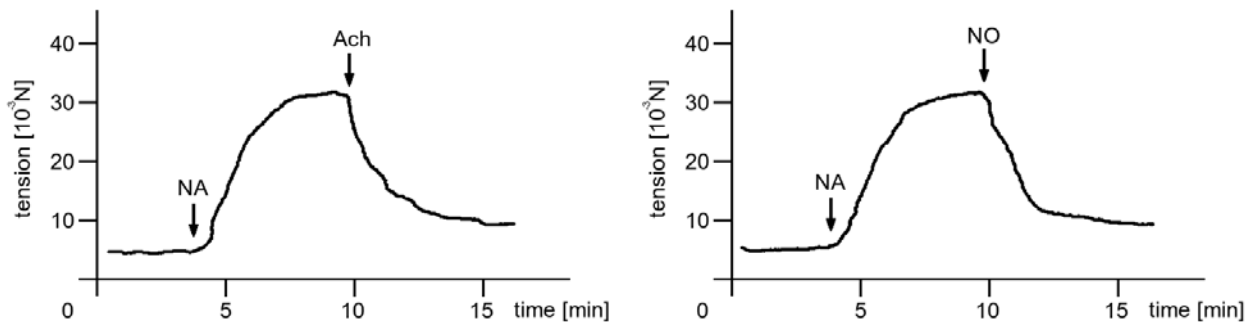
The figure shows a cross section through the wall of an artery:



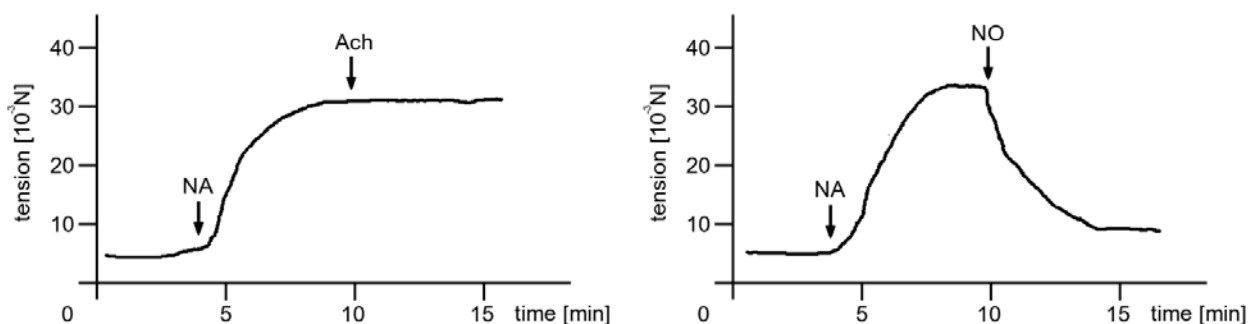
The contractile ability of artery walls is important for regulation of blood pressure. A transverse strip of rabbit aorta was stretched and attached to a dynamometer as shown in the figure:



Contraction of the strip was induced with noradrenaline (NA) and then it was treated with acetylcholine (Ach) and nitric oxide (NO). Its isometric tension was recorded over time. The following profiles were obtained (treatments indicated by arrows):



The experiment was repeated, but this time the layer of endothelium was removed by rubbing with a wooden stick:



- 1 Which of the following can be concluded from the observed results?
  - A Acetylcholine directly induces smooth muscle relaxation.
  - B Acetylcholine induces relaxation of blood vessels.
  - C Acetylcholine damages smooth muscles.
  - D Acetylcholine binds and inhibits noradrenaline.

- 2 Which of the following hypotheses are supported by the obtained results?
- I An agent produced in the endothelium is necessary for the relaxation action of acetylcholine.
  - II NO mediates the relaxation action of acetylcholine
  - III NO is an antagonist of acetylcholine
- |          |         |
|----------|---------|
| A I, III | C I, II |
| B II     | D III   |

## Unit 2

Questions 3 -6

**Optically Active Substance:** An optically active substance is one that rotates the plane of polarised light.

**Chiral molecule:** Molecules which are not superimposable on their mirror images.

**Chiral Center:** An atom to which four different groups are attached.

**Enantiomers:** Stereoisomers that are non-superimposable mirror-images of each other.

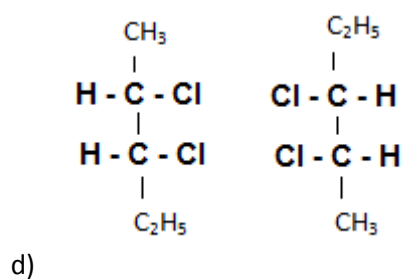
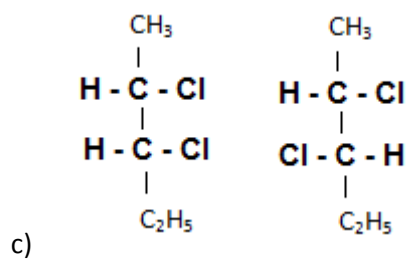
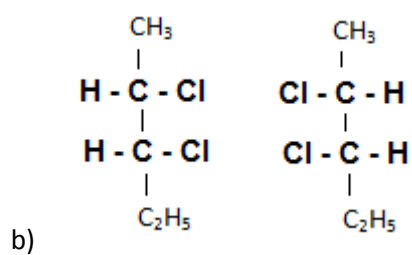
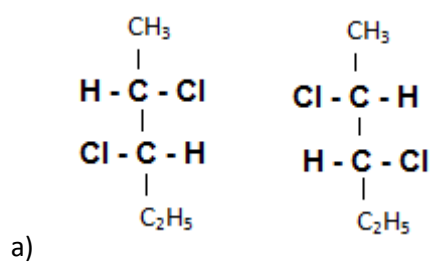
**Diastereomers:** Stereoisomers that are not mirror-images of each other.

**Racemic Modification:** A mixture of equal parts of enantiomers. It is always optically inactive.

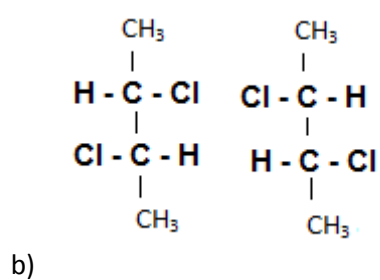
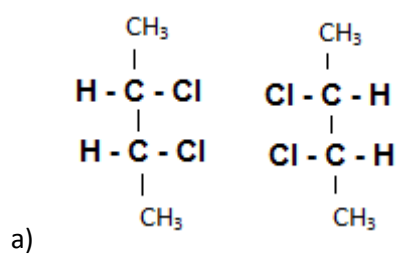
**Meso Compounds:** Molecules that are superimposable on their mirror images, even though they contain a chiral center.

- 3 What is the necessary and sufficient condition for enantiomerism?
- a) Chirality
  - b) Mirror-image
  - c) Both of the above
  - d) None of the above
- 4 Stereoisomers which have similar chemical properties but different physical properties are known as:
- a) Enantiomers
  - b) Diastereomers
  - c) Racemic Modification
  - d) Meso Compounds

5 Which of the following is a pair of enantiomers?



6 Which of the following is a pair of Meso Compounds?





- c) None of these
- d) Both of these

## Unit 3

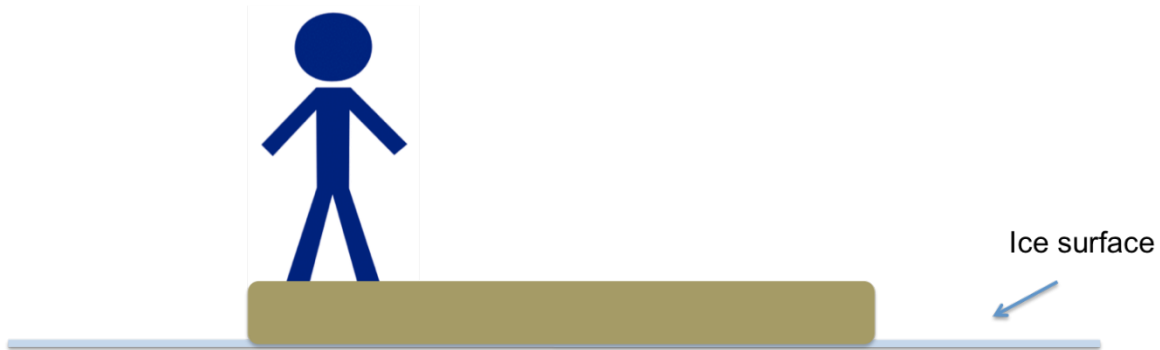
### Questions 7-8

The genetic background of baldness is complicated and still not completely understood. In the simplest model, balding is regulated by a single gene, which exists as two alleles: one determining balding (lets label it  $B$ ) and the other determining non-balding ( $b$ ).  $B$  is completely dominant over  $b$ . This gene is localised on autosomes, but inheritance of baldness is dependent of sex, i.e. when the genome determines balding, it is phenotypically expressed only if the androgen levels are high and the estrogen levels are low. That means, that only males are affected by this symptom.

- 7 Mr & Mrs Smith have numerous offspring. Despite their advanced age, neither Mr Smith nor Mrs Smith show any signs of baldness. However, all of their 10 sons are bald (i.e. we can assume that the probability of Mr & Mrs Smith's male descendant being bald is 100% ). What is the genotype of Mr and Mrs Smith, respectively:
- A Mr Smith:  $bb$ , Mrs Smith:  $Bb$
  - B Mr Smith:  $bb$ , Mrs Smith:  $BB$
  - C Mr Smith:  $BB$ , Mrs Smith:  $bb$
  - D Mr Smith:  $Bb$ , Mrs Smith:  $BB$
- 8 One of the Smiths' daughters married a man, who shows no signs of baldness (let's assume, he will never be bald). What is the probability that their child will not become bald when they grow older?
- |   |     |   |      |
|---|-----|---|------|
| A | 25% | C | 75%  |
| B | 50% | D | 100% |

## Unit 4

### Question 9-10



This figure shows a man standing at rest on top of a piece of wood on top of an ideally smooth ice surface. The man begins to walk from the left end of the wood to the right end of the wood starting at  $t = 0$ . The man is  $80\text{kg}$  and the wood is  $10\text{kg}$ . Assume that there is no friction between the ice and the wood and that the gravitational acceleration ( $g$ ) of a free-falling object is  $10\text{ m}\cdot\text{s}^{-2}$ .

9. Of the following statements, which is NOT true?

- A** When the man starts to walk right with respect to the ice surface, the wood starts to slide left.
- B** If the man is walking at a speed of  $1\text{m}\cdot\text{s}^{-1}$  relative to the ice, then the kinetic energy of the man is  $40\text{J}$ .
- C** The total momentum of the man and the wood system is conserved.
- D** The total mechanic energy of the man and the wood system is conserved.

10. If we measure the normal force  $F_N$  exerted by the ice to the wood, what will  $F_N$  be?

- A** The normal force is  $100\text{N}$ .
- B** The normal force is  $900\text{N}$ .
- C** The normal force is  $800\text{N}$ .
- D** The normal force is  $90\text{N}$ .

## Answers Section 3

### Unit 1

This unit requires candidates to analyse experimental data and make conclusions.

#### Q 1: B

In this experiment it can be observed that acetylcholine induces relaxation of the stripe of rabbit aorta. However, relaxation did not occur when endothelium was removed. Therefore, the statement that acetylcholine directly induces smooth muscle relaxation (A) is false, because endothelium is necessary to mediate this process. If the action of acetylcholine was based on smooth muscle damage (C) or binding and inhibiting noradrenaline (D), relaxation would have been observed independently on the presence of the endothelium. Therefore, the right conclusion is that acetylcholine induces relaxation of blood vessels, as a whole organ (B).

#### Q 2: C

Since the endothelium is necessary for the relaxation, it seems that acetylcholine acts via endothelium, probably interacting with some receptors localised there. Therefore, the message must be somehow transmitted from the epithelium to the layer of smooth muscles. This is likely to be mediated by some agent synthesised in the endothelium upon stimulation by acetylcholine (I). Regarding the fact that NO is able to substitute the function of endothelium, it can be speculated that the agent mentioned above is NO, and NO mediates the the action fop acetylcholine (II). The results of the experiment indicate that acetylcholine and NO have different mechanism of action, but both promote blood vessel relaxation, so they are not antagonists (III).

### Unit 2

#### Q3: C Both of the above

#### Q4: B Diastereomers

Since they are members of the same family, so similar chemical properties but different physical properties like different melting points, Boiling points, Refractive index

#### Q5: A

This is because only this pair has non-superimposable mirror image.

#### Q6: A

Since this pair is the one whose molecules are superimposable on their mirror images even though they contain chiral centers.

### Unit 3

This unit requires candidates to understand differences between genotype and phenotype, comprehend text information given and analyse simple genetic crosses.

#### Q 7: B

Mr Smith is not bald and, because the allele  $B$  determining baldness is dominant, Mr Smith must be a recessive homozygote:  $bb$ . Because all sons of the Smiths are bald, they must have inherited the  $B$  allele from their mother. If she were a heterozygote ( $Bb$ ), only half of the sons would be bald. Therefore, Mrs Smith's genotype is  $BB$ .

#### Q 8: C

The Smith's daughter must have the genotype:  $Bb$  (the  $B$  allele from her mother and  $b$  from her father). According to the assumption made, her husband is  $bb$ . The probabilities of their children's genotypes are: 50% for  $Bb$  and 50% for  $bb$ . The probability that their child will be a male is 50%. To get bald, the child must be both male and have the  $Bb$  phenotype, so the probability of them being bald is  $50\% \times 50\% = 25\%$ . Therefore, the probability of the opposite event (the child not getting bald) is  $100\% - 25\% = 75\%$ .

	female $p=50\%$	male $p=50\%$
$Bb$ $p=50\%$	not bald	bald
$bb$ $p=50\%$	not bald	not bald

### Unit 4

#### Question 9 D

In this process, the chemical energy of the human being is transferred into the mechanical energy of the man and the wood. Before the system has no mechanical energy, and after the man starts walking, the system has non-zero mechanical energy. So D is wrong.

**Question 10 B**

Since the system has no movement in the vertical direction, we apply Newton's Second Law in the vertical direction. There are three forces on the human and wood system: the gravitational force of the man,  $F_{G,M}$ , the gravitational force of the wood,  $F_{G,W}$ , and the normal force  $F_N$  exerted by the ice on the wood. Since  $\sum F = ma = 0$  in this system, we have

$$F_N = F_{G,M} + F_{G,W} = m_M g + m_W g = 80\text{kg} \cdot 10\text{m} \cdot \text{s}^{-2} + 10\text{kg} \cdot 10\text{m} \cdot \text{s}^{-2} = 900\text{N},$$

Where we use the fact that both the gravitational forces are downward, and the normal force is upward.

