

第一大題 1-20 為單選題，每題 2 分共計 40 分，答錯不倒扣，請於試卷上「選擇題作答區」內依序作答。

Article 1

Methane is a greenhouse gas whose concentration in the atmosphere is increasing. Much of this methane is derived from the metabolism of methane-generating (methanogenic) bacteria and over the past two decades much has been learned about the ecology of methanogens; specific inhibitors of methanogenesis, such as 2-bromoethanesulphonic acid, have proved useful in this regard. In contrast, although much is known about the biochemistry of methane-oxidizing (methanotrophic) bacteria, ecological investigations have been hampered by the lack of an analogous specific inhibitor. Methanotrophs limit the flux of methane to the atmosphere from sediments and consume atmospheric methane, but the quantitative importance of methanotrophs in the global methane budget is not well known. Methylfluoride (MF) is known to inhibit oxygen consumption by *Methylococcus capsulatus*, and to inhibit the oxidation of $^{14}\text{CH}_4$ to $^{14}\text{CO}_2$ by endosymbionts in mussel gill tissues. Here we report that methylfluoride inhibits the oxidation of methane by methane monooxygenase, and by using methylfluoride in field investigations, we find that methanotrophic bacteria can consume more than 90% of the methane potentially available. Source: *Nature* 356, 421 - 423 (02 April 1992)

1. Much of the methane in the atmosphere is produced by (A) methanogens (B) methanotrophs (C) greenhouse (D) mussel gill.
2. The purpose of this study is aimed to (A) understand the quantitative importance of methanotrophs (B) use methylfluoride to inhibit *Methylococcus capsulatus* growth (C) study the inhibition of methane monooxygenase by methylfluoride (D) use methylfluoride in the field investigations.
3. The finding of this study is (A) methane-oxidizing bacteria can metabolize more than 90% methane substrate (B) methylfluoride can significantly reduce the amount of methane in the atmosphere (C) methylfluoride can efficiently cut methane budget (D) methylfluoride is better than 2-bromoethanesulphonic acid as an inhibitor.
4. The title of this study is (A) the ecology of methanogens (B) the concentration of methane in the atmosphere is increasing (C) use methylfluoride to inhibit the growth of methane-oxidizing bacteria (D) importance of methane-oxidizing bacteria in the methane budget as revealed by the use of methylfluoride.
5. Which following statement is TRUE? (A) Both methanogens and methanotrophs are aerobic, (B) Both methanogens and methanotrophs are anaerobic (C) Methanogens are anaerobic and methanotrophs are aerobic (D) Methanogens are aerobic and methanotrophs are anaerobic.
6. Over the past 20 years, which following statement is TRUE? (A) Both the ecology of methanogens and methanotrophs are clearly understood, (B) Only the ecology of methanogens are clearly understood (C) Only the ecology of methanotrophs are clearly understood (D) Both the ecology of methanogens and methanotrophs are not understood.
7. How many carbons are in the formula of 2-bromoethanesulphonic acid? (A) None (B) One (C) Two (D) Three.
8. The molecular mass of $^{14}\text{CH}_4$ is (A) 14 (B) 16 (C) 18 (D) 20.
9. Which following statement is TRUE? (A) Methanogenesis is the degradation of methane by methanogens

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- (B) The terminal electron acceptor of methanogenesis is oxygen (C) Methanogenesis needs methane monooxygenase (D) Methanogenesis is inhibited by 2-bromoethanesulphonic acid.
10. Which following statement is FALSE? (A) Methanotrophs can consume atmosphere methane. (B) Methanotrophs decrease the flux of methane to atmosphere from sediments. (C) *Methylococcus capsulatus* can synthesize methane. (D) Methylfluoride is an analogous specific inhibitor of methane monooxygenase.

Article 2

Estimates of the number of vegetarians in the United States range from less than 1% to 4% of the population (Nationwide Food Consumption Survey, 1984; Blix, 1989; O'Connell et al., 1989). The vast majority of vegetarians in this country eat dairy products and eggs; from 2 to 9% of U.S. vegetarians are vegans (Freeland- Graves et al., 1986b; Herbert, 1990). A vegan (also called strict, pure, or total vegetarian) avoids all animal products. No estimates have been found of the number of vegans under 18 years of age or of the number of vegan women who become pregnant.

George (1990) advanced the thesis that many people including infants, children, and pregnant and lactating women would be adversely affected by a vegan diet. Pluhar (1993) and Varner (1994) have recently responded to George. Several scientific questions have been raised by this philosophical debate as identified by Comstock (1994). The purpose of this article is to respond to these nutritional questions.

Although many people believe that vegetarianism in the U.S. is a relatively recent phenomenon, early nutrition texts actually recommended that children avoid meat for at least their first 7 years (Rose, 1919; Bogart, 1943) although they did recommend that dairy products and eggs be included in children's diets. In 1954, the first large-scale study of vegetarian and non-vegetarian adolescents found that lacto-ovo vegetarian diets met all known nutritional needs (Hardinge and Stare, 1954).

In the late 1960s and early 1970s, many young U.S. adults adopted vegetarian diets as a part of the counter-culture movement (Brown and Bergan, 1975; Calkins, 1979). These individuals were often described as "new" vegetarians because their eating habits and food selections were often widely different from those of groups traditionally following vegetarian diets such as the Seventh-day Adventists. Lack of knowledge about nutrition, mistrust of the medical establishment, and limited access to foods considered acceptable led to deficiencies of energy (Roberts et al., 1979) and of nutrients such as iron (Dwyer et al., 1982), vitamin D (Dwyer, 1979; Curtis 1983), and protein (Roberts et al., 1979), especially among children. Studies of "new" vegetarians are often cited as evidence of the unsuitability of vegan diets for pregnant and lactating women, infants, and children.

Marked changes in attitudes, beliefs, and practices of adult vegetarians have occurred since the 1970s (Freeland-Graves et al., 1986a,b). Differences in child feeding practices of many vegetarian parents would therefore be expected. Little information is available on the nutritional status of women, infants, and children following "newer" vegetarian diets. These "newer" vegetarians are often more mainstream than the "new" vegetarians of the 1960s and 1970s. In addition, a much wider variety of nutritious, easy-to-prepare food is available to today's vegan. Popular cookbooks of the 1960s and 1970s describe production of tofu, soy milk, tempeh, soy yogurt, and other foods commonly eaten by vegans (Robertson et al., 1976; Hagler, 1978). Food preparation could easily involve many hours weekly. Today these foods and many more are available in prepared form in neighborhood grocery stores. Certainly, easier access to foods such as these makes it more likely that they will be included in the diet.

Infants, children, adolescents, and pregnant and lactating women have been described as groups with special nutritional needs (American Dietetic Association, 1993; Dwyer 1993). These groups all have higher requirements for nutrients per calorie than adult males. Because of these higher requirements, regardless of the diet chosen, these groups will always be at greater risk of developing nutritional deficiencies than adult males. This recognition of the vulnerability of these groups has led to the development of programs such as School Breakfast and Lunch Programs, Child Care Food Program, Special Supplemental Food Program for Women, Infants, and Children (WIC), and Commodity Supplemental Food Program which target individuals in these groups and not adult males (U.S. Department of Health and Human Services, 1988).

Yes, we can conclude that pregnant and lactating women, infants, children, and adolescents are at greater risk of developing nutritional deficiencies on a vegan diet than adult males. However, the same could be concluded for pregnant and lactating women, infants, children, and adolescents on a non-vegetarian regimen. This difference in risk is not sufficient reason to discourage individuals from choosing vegan diets.

Indeed, some consideration should be given to the risks associated with following a standard American diet during childhood. Conditions such as obesity and cardiovascular disease appear to have origins in childhood (Freedman et al., 1987a,b; Pathobiological Determinants of Obesity in Youth Research Group 1990).

Obesity is the most common nutritional disease in children and adolescents in the U.S. (Dietz, 1993). More than 40% of children who are obese at age 7 become obese adults (Stark et al., 1981) while about 70% of children who are obese at age 10-13 become obese adults (Abraham et al., 1970; Birch, 1980). Obesity in adults increases risk of non-insulin dependent diabetes mellitus, hypertension, cardiovascular disease, and other serious medical problems.

The atherosclerotic process begins in childhood (Brown et al., 1993). Elevated total cholesterol and LDL-cholesterol and reduced HDL-cholesterol in children often persist into adulthood (Brown et al., 1993).

Numerous studies have demonstrated that adults following vegetarian diets have reduced risk of developing several chronic degenerative diseases including obesity, cardiovascular disease, hypertension, diabetes mellitus, and certain cancers (Dwyer, 1988; Snowdon, 1988). Because no longitudinal studies of Western children following vegetarian or vegan diets from birth through adulthood are available, we cannot conclusively determine whether or not early use of vegetarian or vegan diets reduces risk of later development of chronic disease. We do know that vegan children tend to be somewhat lighter than standards (Sanders, 1988; O'Connell, 1989) and that vegetarians as a group tend to be lean (American Dietetic Association, 1993). Diets of vegan children do not contain cholesterol. Intake of fat would be expected to be lower and of fiber to be higher than that of the general population. Studies using a cholesterol-free vegetarian diet that was low in saturated fats or using soy protein and a high polyunsaturated fat diet have resulted in reductions of total cholesterol and LDL-cholesterol (Fernandes et al., 1981; Gaddi et al., 1987). These results suggest that some components of a vegan diet could help to reduce the risk of cardiovascular disease.

Models such as the Food Guide Pyramid help to ensure appropriate diets for the general population. Meal guides also exist to help ensure appropriate diets for vegans and other vegetarians (Vyhmeister et al., 1977; Truesdell and Acosta, 1985; Mutch, 1988; American Dietetic Association 1992).

When conditions of poverty are superimposed on individuals with special needs, it can become even more difficult to achieve nutritional adequacy regardless of chosen diet. Certainly, nutritionally adequate vegan diets are potentially less costly than meat-based diets if foods are appropriately selected. A low-cost meal plan has been devised for vegans using foods available in supermarkets (Ransom, 1990). This plan compares favorably

in cost with other budget menus (R. Mangels, unpublished data).

In order to truly determine the degree of risk associated with adherence to a vegan diet by groups with special needs, controlled studies would be needed comparing a randomly sampled vegan population with an appropriately matched (age, ethnicity, socioeconomic status, education, etc.) non-vegetarian population. It is unlikely that such a study will ever be conducted. As Dwyer and Loew (1994) point out, vegan diets are heterogeneous. Furthermore, a truly comprehensive study of vegans in the U.S. would require a multi-center study since most vegans are not located in one or two areas and we do not know whether or not there are regional differences in vegan diets. A study of this type would be very costly and time-consuming. Ideally all vegans would be studied. However, identification of all U.S. vegans would not be feasible. There is no central registry of vegans in this country and many choose not to affiliate with vegan or vegetarian organizations. In addition, those vegans who choose to participate in a study may do so because they are more aware of nutrition, thus leading to a potential for self-selection bias.

Since we are unable to identify a single study which comprehensively examines the nutritional status of pregnant and lactating vegan women, infants, and children, we will briefly review the existing studies of these groups. We limit our discussion to studies of vegans in the U.S. and other developed countries. Differences in food selection between vegetarians using dairy products and eggs and vegans are significant enough that it is not appropriate to extrapolate from the numerous studies of lacto-ovo vegetarians. While some authors group macrobiotic and vegan diets in the same category, we do not believe this is appropriate. Macrobiotic diets can include animal products such as fish. In addition, numerous proscriptions such as avoidance of concentrated calorie sources like oils and nut butters for children under 2 (Kushi and Kushi, 1985, 1986), commonly make the macrobiotic diet inadequate in energy. Since such proscriptions go beyond the food avoidances of vegans, it is not possible to say that nutritional problems seen in macrobiotics are solely due to the vegan nature of their diets.

Carter et al. (1987) examined vegan pregnancies between 1977 and 1982 on The Farm, an intentional community. They concluded that normal pregnancy was quite possible on a vegan diet. The study subjects received prenatal care and used prenatal vitamins, calcium, and iron. Maternal weight gain was adequate and infant birth weights were normal. Preeclampsia, a complication of pregnancy, was seen in only one pregnancy out of 775 studied. While most U.S. vegans do not live in communities such as The Farm, this study certainly illustrates that vegan pregnancy can take place with few if any complications for mothers or infants.

No comprehensive studies were found of lactating vegans in the U.S. There are case reports of vitamin B₁₂ deficiency in breast-fed infants of vegans (Food and Nutrition Board, 1991). These certainly point to the need for vitamin B₁₂ supplementation in lactating vegans. Normal growth has been seen in infants of lactating vegans during the first 6 months when infants received breast milk exclusively (O'Connell et al., 1989).

The period in which infants are weaned from milk-based diets to table foods is a time of nutritional vulnerability. Breast-fed infants appear to have different growth rates compared to non-breast-fed infants (Dewey et al., 1992). Mode of feeding is frequently not controlled for in studies of vegan infants so some deviations from growth of vegan compared to non-vegetarian infants can conceivably be attributed to the tendency of more vegan infants to be breast fed and to be breast fed for a longer time (Sanders, 1988; O'Connell et al., 1989).

Children consuming vegan diets on The Farm had mean heights from 0.2 to 2.1 cm below and mean weights from 0.1 to 1.1 kg below the National Center for Health Statistics reference median (O'Connell et al.,

1989). Many of these children did receive vitamin and mineral supplements, the most common being vitamins A, D, and B₁₂ (O'Connell et al., 1989). British vegan children were smaller and lighter than standards but appeared to be growing normally (Sanders, 1988). In contrast, children on apparently inadequate macrobiotic diets continue to be below the 50th and often below the 5th percentile for height and weight for age even several years after weaning (Dagnelie et al., 1988; Miller et al., 1991).

There is some suggestion that vegetarian girls may have a later adolescent growth spurt and later onset of menses (Sabate et al., 1992). This different pattern of growth may reduce the risk of breast cancer since being older at menarche is associated with a lower risk of later breast cancer. It is conceivable that a similar delayed growth spurt could be seen in vegan girls although this has not been documented.

Mean protein content of diets of vegan children has been shown to meet or exceed current recommendations (Fulton et al., 1980) although it may be lower than protein in diets of non-vegetarian children. Mean intakes of essential amino acids of 48 vegan children aged 2-5 years markedly exceeded World Health Organization recommendations for essential amino acids for 2-year-old children (Fulton et al., 1980).

Mean intakes of most vitamins by vegan children have been shown to meet or exceed current recommendations (Fulton et al., 1980). Vitamin B₁₂ and vitamin D have been reported to be low in diets of vegan children (Sanders, 1988). Iron deficiency is the most common nutritional deficiency in the U.S. (Dallman, 1990) and can occur in both vegetarian and non-vegetarian children. Calculated mean iron intakes of vegan children have been reported to exceed currently recommended levels (Fulton et al., 1980; Sanders, 1988). Vegan diets do not contain heme iron, a highly available form of iron. However, vegan diets are frequently high in ascorbic acid (Fulton et al., 1980) which enhances non-heme iron absorption (Food and Nutrition Board, 1989b). Dietary calcium intakes below recommendations have been seen in vegan children (Fulton et al., 1980; Sanders, 1988). Source: *Journal of Agricultural and Environmental Ethics* 1994, 7(1) 111-122

11. What could be the reason(s) which led to deficiencies of nutrients among "new" vegetarians in the late 1960s and early 1970s? (A) mistrust of the medical establishment (B) limited access to foods considered acceptable (C) lack of knowledge about nutrition (D) all of the above.
12. The number of vegans in the population of the United States is estimated to be (A) 1 to 4% (B) 0.02 to 0.09% (C) 0.02 to 0.36% (D) 0.08 to 0.36%.
13. Who said that many people including pregnant and lactating women would be adversely affected by a vegan diet? (A) Pluhar (B) George (C) Varner (D) all of the above.
14. Most vegetarians in the United States eat (A) dairy products and eggs (B) dairy products (C) eggs (D) none of the above.
15. How could a vegan diet help the people in the United States? (A) Reduce the risk of cardiovascular disease (B) reduce obesity (C) reduce diabetes mellitus (D) all of the above.
16. What is the best title for this paper? (A) Vegetarian diets for preventing malnutrition (B) The benefits of vegetarian diets (C) Vegan diets for women, infants, and children (D) Vegetarian diets for women, infants, and children.
17. Which one of the following statement is not true? (A) Vegan diets are adequate in nutrients (B) vegan diets are more expensive (C) vegan diets do not contain cholesterols (D) there are meal guides to help ensure appropriate diets for vegans.
18. Why studies of "new" vegetarians were often cited as evidence of the unsuitability of vegan diets for

- children? (A) Many of them were deficient in energy (B) many of them were healthy (C) many of them did not like animal products (D) all of the above.
19. Which one of the following statement is true? (A) There is a need for vitamin D supplementation in vegans (B) there is a need for vitamin B₁₂ supplementation in vegans (C) there is a need for iron supplementation in vegans (D) all of the above.
20. What could be a sufficient reason to discourage adolescents from choosing vegan diets? (A) None of the followings (B) they have special nutritional needs (C) they are at greater risk of developing nutritional deficiencies on a vegan diet than adult males (D) they have higher requirements for nutrients.

第二大題 共 20 小題，每題 2 分共計 40 分，請於試卷上「非選擇題作答區」內，寫出題

號 1-20，並請依各試題說明，依序作答，答錯倒扣 1 分。

Article 3

Sesame seed is one of the important oil seed crops in the world. It is not only a good source of edible oil, but also widely used in baked goods and confectionery products. Traditionally, sesame is considered as a healthy food in Oriental countries. For example, it has been reported that sesame exhibits antioxidant, anti-hypertension and anti-cancer activities, and also possesses the ability to reduce cholesterol and to improve liver function. Lignans and lignan glycosides present in sesame appear to be the important functional components. Lignans are found in sesame oil, while lignan glycosides exist mainly in the defatted sesame meal.

Sesame seeds are often roasted to enhance the aroma and oxidative stability of sesame oil in addition to facilitate the pressing of the oil. Source: J. Food and Drug Analysis 17, 300-306 (2009)

Please mark True (O) or False (X) for the following 1-10 statements:

1. Sesame seeds are used mainly as an edible oil source.
2. Sesame lignans are present in sesame oil only since it is oil soluble.
3. Most of the sesame oils are produced from roasted sesame seeds.
4. Sesame meal contains lignans which are the components responsible for its antioxidant, anti-hypertension and anti-cancer activities.

Article 4

Melamine is an organic base chemical most commonly found in the form of white crystals rich in nitrogen. Melamine is widely used in plastics, adhesives, countertops, dishware, whiteboards.

In China, where adulteration has occurred, water has been added to raw milk to increase its volume. As a result of this dilution the milk has a lower protein concentration. Companies using the milk for further production (e.g. of powdered infant formula) normally check the protein level through a test measuring nitrogen content. The addition of melamine increases the nitrogen content of the milk and therefore its apparent protein content.

In 2007, melamine was found in wheat gluten and rice protein concentrate exported from China and used in the manufacture of pet food in the United States. This caused the death of a large number of dogs and cats due to kidney failure.

While there are no direct human studies on the effect of melamine data from animal studies can be used to

predict adverse health effects. Melamine alone causes bladder stones in animal tests. When combined with cyanuric acid, which may also be present in melamine powder, melamine can form crystals that can give rise to kidney stones. These small crystals can also block the small tubes in the kidney potentially stopping the production of urine, causing kidney failure and, in some cases, death. Source: <http://www.who.int/csr/media/faq/QAmelamine/en/index.html>

5. Melamine was not permitted to be used in food nor feed.
6. In China, milk was adulterated with melamine to increase the nitrogen content of raw milk.
7. Melamine is an toxic environment contaminants.
8. Melamine has been used in animal feeds as an feed additive to increase nitrogen contents.
9. The kidney stones, which block the small tubes in the kidney and eventually lead to kidney failure and death, are formed by melamine alone.
10. There is no direct human studies on the effect of melamine. The death of Chinese babies may not be caused by melamine only.

Article 5

Calcium, combined with vitamin D and weight-bearing exercise, keeps bone loss from getting worse or helps reduce the rate of bone loss that occurs with osteoporosis. And one study showed that vitamin D may reduce an older person's risk for falling by 22%.

Your bones need vitamin D to absorb calcium. Most doctors suggest daily vitamin D supplements for children and teens, starting by age 2 months. Talk with your doctor about how much and what sources of vitamin D are right for your child. The recommended daily intake is 400 to 800 IU for adults ages 19 to 50, and 800 to 1,000 IU a day for adults age 50 and older.

If you live in a sunny climate, you can get enough vitamin D through 10 to 15 minutes per day of sun exposure a few days a week; however, older people may not get enough this way. You can also get vitamin D in foods such as egg yolks, liver, saltwater fish, and dairy products fortified with vitamin D. Taking a vitamin D supplement along with your calcium can help strengthen your bones. Source: <http://www.aolhealth.com/action-set/osteoporosis-taking-calcium/why-is-calcium-used-to-treat-or-prevent-osteoporosis>

Please indicate the following 11-20 statements are Yes, No or Not Given according to the article. Write Y, N or NG respectively. Yes (Y) if the statement agrees with the article; No (N) if the statement contradicts with the article; Not Given (NG) if the statement is not mentioned in the article.

11. The symptoms of bone loss can ameliorate by taking vitamin D.
12. A large proportion of doctors think teenagers do not need vitamin D supplements.
13. The older an adult is, the more vitamin D supplements he or she needs.
14. You can get enough vitamin D through exposure under sunshine no matter what environment you live.
15. You can obtain vitamin D via eating legumes.

Article 6

Phytochemicals are natural compounds found in fruit, vegetables and other plants. In fact, the term "phyto" derives from the Greek word for "plant." There are well over a thousand known phytochemicals and

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possibly many more waiting to be discovered.

Known phytochemicals have a broad range of protective benefits -- from reducing inflammation, to speeding healing, to preventing infection, to curbing cancer. Phytochemicals are not essential to humans -- i.e. not required by the body to sustain life -- but they are essential to plants, such as fruit and vegetables. Phytochemicals are plants' self-protection program: they help shield young buds and sprouts from predators, pollution, the elements, etc. When we eat fruit and vegetables containing phytochemicals, they pass along to us many of these evolved protective benefits.

Some phytochemicals are plant pigments, lending their vivid hues -- red, orange, blue, purple -- to various fruit and vegetables. Many phytochemicals are antioxidants with lycopene, quercetin and beta-carotene being some of the better-known examples. Phytochemicals also include plant enzymes (such as pineapple's bromelain), phytoestrogens - which mimic human hormones (such as soy isoflavones) and glucosinolates which activate our own detoxifying enzymes (such as sulforaphane in cabbage). Source: <http://www.dole.com/Phytochemicals/tabid/859/Default.aspx>

16. Currently, all phytochemicals are known by scientists.
17. Phytochemicals are indispensable for plants as well as for human beings.
18. Phytochemicals can be used to treat autoimmune diseases.
19. Some fruits are colorful because of phytochemicals.
20. Phytoestrogens and human hormones are identical.

第三大題 中翻英（9分，每題3分）請於試卷上「非選擇題作答區」內依序作答。

1. 我感興趣的不是食品化學，而是食品微生物學。
2. 無論如何，他一定吃了很多東西，因為現在他胖了。
3. 它不像其他食物那樣受歡迎。

第四大題 英翻中（11分）

Vegetable waste typically has high moisture content and high levels of protein, vitamins and minerals. Its value as an agricultural feed can be enhanced through solid-state fermentation. Fermentation was carried out for 9 days at 35% moisture level and neutral pH. The crude fat and crude fibre content showed significant reduction at the end of fermentation. Nitrogen free extract showed a gradual decrease during the fermentation process.