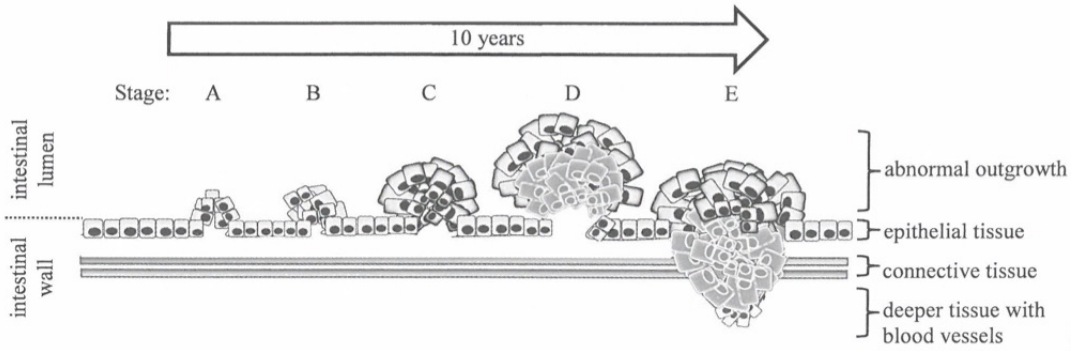
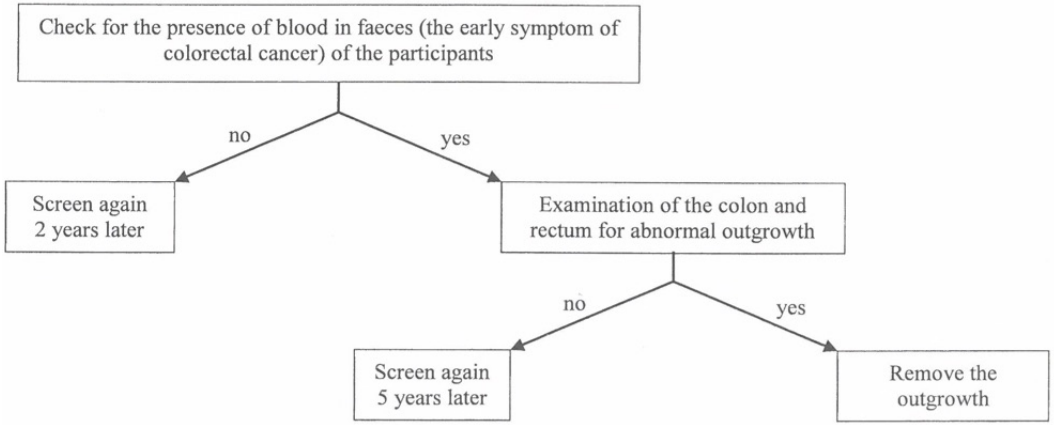
7. Colorectal cancer is one of the most common cancers in Hong Kong. The schematic diagram below shows the developmental stages of colorectal cancer over time:



(a) Which stage of colorectal cancer has a high risk of spreading? Explain your answer. (2 marks)

(b) The Department of Health in Hong Kong has launched a regular screening programme for the prevention of colorectal cancer. The flowchart below illustrates the screening programme:



(i) The screening programme is recommended for people aged 50 or above. Give ***two*** reasons why this group of people is more susceptible to colorectal cancer. (2 marks)

(ii) If there is no abnormal outgrowth of the epithelium of the large intestine, the next screening can be conducted 5 years later. With reference to the developmental stages of colorectal cancer, explain this practice. (1 mark)

(iii) Recently, there is a growing trend of people diagnosed with colorectal cancer at a younger age. Suggest ***two*** eating habits which may lead to this growing trend. (2 marks)

You are required to present your answer to the following question in essay form. Criteria for marking will include relevant content, logical presentation and clarity of expression.

11. Recently, the use of the ketogenic diet for achieving weight loss is becoming popular. In fact, this high-fat, moderate-protein and very-low-carbohydrate diet has been used as an approach to control the blood glucose level in diabetics. However, the effectiveness of this diet in achieving weight loss is still controversial.

Describe how a ketogenic diet can be used to control the blood glucose level in diabetics. Evaluate the possibility of using this diet for weight loss and discuss the health concerns of adopting such a diet for healthy persons. (12 marks)

DSE M.C. Questions - Health and diseases
(sort by difficulty)

Challenging

2015 Q.32 (38%)

Directions: Questions 32 and 33 refer to the table below, which shows the results of blood tests for the presence of antigens and antibodies of hepatitis B in four individuals:

	Individual 1	Individual 2	Individual 3	Individual 4
Antigens of hepatitis B	Negative	Positive	Negative	Positive
Antibodies of hepatitis B	Negative	Negative	Positive	Positive

Which individual(s) would you recommend for vaccination against hepatitis B?

A. 1 only
B. 4 only
C. 1 and 2 only
D. 1 and 3 only

2015 Q.36 (34%)

Which of the following components of blood are involved in forming a blood clot?

(1) Blood platelets
(2) Red blood cells
(3) White blood cells

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

Average

2012 Q.35 (71%)

Which of the following belongs to humoral immune response?

A. blood clotting
B. production of antibodies
C. phagocytosis of pathogens
D. production of memory T cells

2012 Q.36 (70%)

After injury, the wound usually becomes swollen due to

A. accumulation of bacteria at the wound.
B. accumulation of tissue fluid at the wound.
C. increased phagocytosis at the wound.
D. increased blood flow to the capillaries around the wound.

2014 Q.32 (61%)

Infants can obtain antibodies from breast feeding. Which of the following combinations correctly describes this type of immunity in infants?

	Type of immunity	*Explanation*
A.	active	the antibodies are produced from white blood cells
B.	active	the antibodies attack pathogens bearing foreign antigens
C.	passive	the antibodies do not trigger the production of memory cells
D.	passive	the antibodies work only when there is re-entry of the same pathogen

2015 Q.34 (47%)

Directions: Questions 34 and 35 refer to the list of factors shown below.

(1) Smoking
(2) Family history
(3) Overweight
(4) Radiation

Which of the above factors can be controlled by lifestyle adjustment?

A. (1) and (3) only B. (2) and (4) only C. (1), (2) and (3) only D. (1), (3) and (4) only

Average

2019 Q.35 (48%)
Type II diabetic patients may feel dizzy after prolonged exercise. Which of the following is the most likely explanation for this?

A. Their blood glucose level has dropped to too low a level because they do not have enough stored glycogen to replenish the glucose level.
B. Their blood glucose level has dropped to too low a level because they do not have enough glucagon to stimulate the conversion of glycogen to glucose.
C. Their blood glucose level has risen to too high a level because they keep losing water during exercise.
D. Their blood glucose level has risen to too high a level because they do not have enough insulin to stimulate the conversion of glucose to glycogen.

2019 Q.36 (66%)
Antibodies are produced by

A. Memory B cells.
B. Memory T cells
C. Specialised B cells.
D. Specialized T cells.

Easy

2013 Q.32 (47%)
Which of the following descriptions about antibiotics is correct?

A. Antibiotics can engulf pathogens.
B. Antibiotics can be produced by fungi.
C. Antibiotics can bind to specific antigens.
D. Antibiotics can be produced by lymphocytes.

Easy

2013 Q.34 (81%)
Which of the following information concerning the characteristics of insulin-dependent diabetes and non-insulin-dependent diabetes is correct?

	Insulin-dependent diabetes	*Non-insulin-dependent diabetes*
A.	accounts for the majority of diabetic cases	accounts for a small portion of diabetic cases
B.	is mainly due to an unhealthy lifestyle	is mainly due to hereditary factors
C.	requires regular injections of insulin	may be controlled through proper diet
D.	body fails to respond to insulin	body produces a low level of insulin

2015 Q.33 (80%)
Directions: Questions 32 and 33 refer to the table below, which shows the results of blood tests for the presence of antigens and antibodies of hepatitis B in four individuals:

Hepatitis B is transmitted through
A. insects.
B. droplets.
C. body fluid.
D. skin contact.

2015 Q.35 (81%)
Directions: Questions 34 and 35 refer to the list of factors shown below.
(1) Smoking
(2) Family history
(3) Overweight
(4) Radiation

Which of the above are risk factors for coronary heart disease?
A. (1) and (3) only
B. (1), (2) and (3) only
C. (1), (2) and (4) only
D. (2), (3) and (4) only

Easy

2017 Q.36 (78%)

Which of the following combinations correctly matches the type of diabetes with its description?

Type of diabetes	*Description*
A. Insulin-dependent (type I)	Heredity is the major cause.
B. Insulin-dependent (type II)	Blood insulin remains high.
C. Non-insulin-dependent (type II)	Blood glucose revel remains low even after meal
D. Non-insulin-dependent (type II)	Blood glucose level will drop significantly after insulin injection.

2018 Q.10 (78%)

Which of the following statements best explain why vaccination against flu is administered annually?

A. The flu virus is constantly mutating
B. The antibodies against flu virus only last for one year
C. The flu vaccine is not very effective because it is made from a weakened virus
D. When memory cells encounter the flu vaccine again, a secondary response is triggered

2020 Q.29

29. Which of the following combinations of causative agents and ways of transmission of infectious diseases is correct?

	Infectious disease	*Causative agent*	*Way of transmission*
A.	cholera	virus	food
B.	cholera	bacterium	body fluid
C.	hepatitis B	virus	body fluid
D.	hepatitis B	bacterium	food

2020 Q.30

30. Which of the following provides immunity to the human body?

A. phagocytosis
B. inflammation
C. memory cell
D. formation of blood clots

2021 Q.24,25

24. Which of the following types of cells can be found in the tissue fluid?

(1) B cell
(2) T cell
(3) phagocyte

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

25. Which of the following is ***not*** the first line of defence against the invasion of pathogens in humans?

A. saliva
B. sweat
C. mucus
D. lymph

Answers

Challenging

2015
32 [A]
36 [D]

Average

2012	2014	2015	2019
35 [B]	32 [C]	34 [D]	35 [A]
36 [B]			36 [C]

Easy

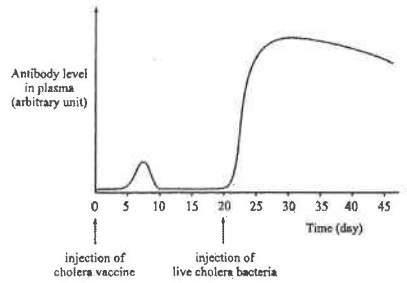
2013	2015	2017	2018
32 [B]	33 [C]	36 [A]	10 [A]
34 [C]	35 [B]		

2020
29 [C]
30 [C]

Past papers – Health and diseases

CE - 2003

4. (c) Cholera is a human disease caused by a type of bacteria. It is transmitted through contaminated water and food. A vaccine against this disease is made up of killed cholera bacteria. To study the effectiveness of the vaccine, a mouse was first injected with the vaccine and then with live cholera bacteria 20 days later. During the study, the mouse showed no sign of cholera. The changes in the antibody level in the plasma of the mouse are shown in the graph below:



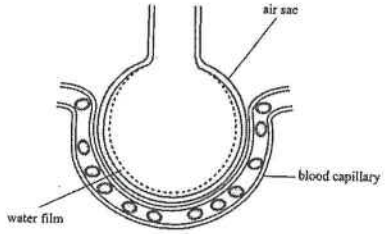
(i) Explain the rise in the antibody level between day 5 and day 7. (2)

(ii) State two differences between the patterns of antibody production as induced by the two injections. Suggest an explanation for such differences. (5)

(iii) People may be infected with cholera through eating contaminated seafood. Besides vaccination, suggest two ways to reduce the risk of cholera infection through eating seafood. (2)

CE - 2004

1. (c) The diagram below shows an air sac of the lung and its blood supply:



(i) Explain the importance of the water film in gaseous exchange. (2)

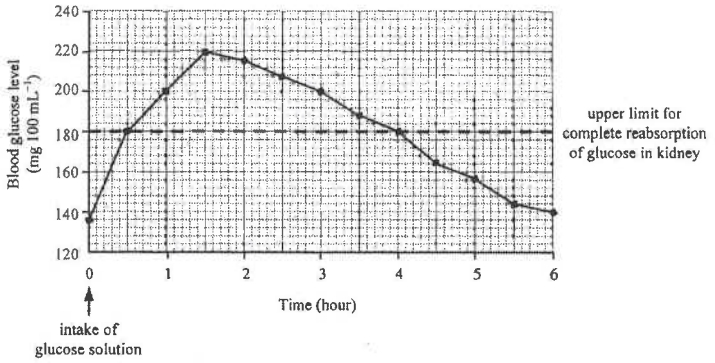
(ii) SARS patients may have fluid accumulated in the air sacs. Explain how the accumulation of fluid may affect the oxygen content of the blood of the patients.(3)

(iii) One method of confirm whether a patient is infected with the SARS virus is to test for the presence of antibodies against this virus in the patient's blood. Explain why these antibodies will be produced by a SARS patient. (2)

(iv) Suggest a method that can help the body develop immunity against SARS. Explain how the immunity is developed. (4)

CE - 2005

9. (a) In a medical test, George drank a glass of glucose solution. The graph below shows the subsequent changes of his blood glucose level:



(i) Based on the graph, state the period in which the urine of George would contain glucose. Explain why glucose in the blood would appear in the urine during this period. (4)

(ii) The doctor diagnosed that George had diabetes mellitus and advised him to get insulin injection for treatment. Which organ of George was likely to be defective? (1)

(iii) The insulin used for treating diabetes mellitus can be obtained from pigs and cattle, or produced by genetically modified bacteria. State two advantages of using insulin produced by the bacteria over that obtained from mammals. (2)

(iv) (1) Besides insulin, name another hormone that is responsible for the regulation of blood glucose level. (1)

(2) State one effect of this hormone on the activity of liver cells. (1)

CE - 2008

8. (b) The following information is extracted from a pamphlet for diabetic patients. Read the content and answer the questions that follow.

> Hypoglycaemia
>
> When there is a very low level of glucose in the blood (below 50 mg per 100 cm^3), hypoglycaemia occurs. Hypoglycaemia usually happens quickly and the symptoms include sweating, hunger, tiredness, anxiety and dizziness, etc. Hypoglycaemia may occur because:
> - you have eaten too little, or
> - you are late for a meal, or
> - you have injected too much insulin, or
> - you have a lot more exercise than usual.
>
> It is important always to carry some sweets with you and take them immediately when you suffer from hypoglycaemia.

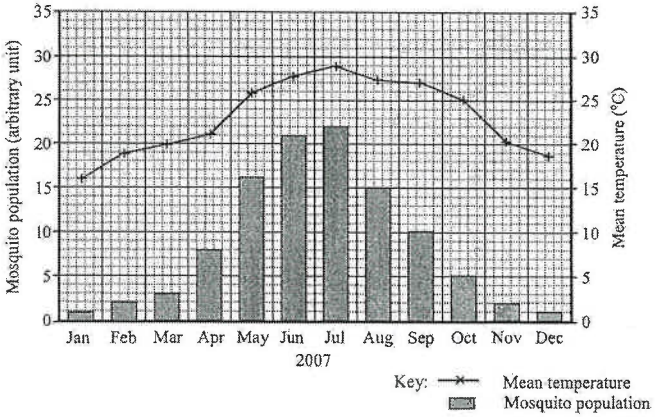
(i) Explain why a diabetic patient may suffer from hypoglycaemia if he has taken more exercise than usual. (4)

(ii) It is recommended for diabetic patients to take in complex carbohydrates (a variety of polysaccharides) in their normal meal instead of sugar. Suggest why these patients are advised to take different types of carbohydrates under normal and hypoglycaemic conditions.

(1) Take in complex carbohydrates in normal meal (3)
(2) Take in sugar when hypoglycaemia occurs (2)

CE - 2009

6. Dengue fever is an acute viral disease. Prevention of this disease mainly depends on controlling the mosquito population. Since 2000, the Food and Environment Hygiene Department (FEHD) has been monitoring the mosquito population in Hong Kong. The graph below shows the monthly mosquito population in a certain district and the monthly mean temperature in 2007.



(a) Suggest why the mosquito population is related to the incidence of dengue fever. (1 mark)

(b) Based on the information from the graph, suggest how temperature may affect the breeding of mosquitoes. (2 marks)

(c) The risk of the spreading of dengue fever is graded by the FEHD as high when the mosquito population is 20 arbitrary units or above. The FEHD will conduct special operations to eliminate potential breeding places for mosquitoes.

(i) In which months were special operations conducted in 2007? (1 mark)

(ii) The Hong Kong Observatory has estimated that the annual temperature in Hong Kong will increase in the coming decades. Predict how this will affect the transmission of dengue fever. Justify your answer. (3 marks)

(iii) If the mosquito population in the district you live is reported to be above 20 arbitrary units, suggest ***one*** way to protect yourself from contracting dengue fever. (1 mark)

CE - 2010

8. (a) Influenza is a common disease caused by viruses. The Centre for Health Protection of Hong Kong states. "Influenza vaccination is important because it is one of the effective ways in preventing this disease."

(i) Explain how vaccination can help to prevent influenza. (4)
(ii) Suggest why elderly people are recommended to receive influenza vaccination. (1)
(iii) It is known that smoking can inhibit the beating of cilia in the respiratory tract. Suggest how smoking may result in a higher chance of influenza infection. (2)
(iv) Influenza viruses undergo mutation easily. Explain why this characteristic of viruses makes the control of influenza more difficult. (2)

AL - 2005 1A

3. Complete the following paragraph with suitable word(s):

Cholera is caused by a bacterium, Vibrio cholerae, which is transmitted directly through (a)_____. In sub-tropical areas, there is a distinct seasonal pattern of this disease, with the highest incidence in the (b)_____season. The incidence of cholera can be reduced by taking proper precautionary measures such as (c)_____and (d) _____. (4)

AL - 2005 1C

12. Read the following passage and then answer the questions that follow.

Lifestyle and major diseases in Hong Kong

Lifestyle plays an important role in health and disease. Several major diseases in Hong Kong can be linked to unhealthy lifestyles

Coronary heart disease is one the major causes of death in developed countries. In Hong Kong, it accounts for over 3000 deaths every year and is the second most common cause of death. In the past, this disease affected people of higher social status more than the working class. This trend reversed in Western countries during the 1970s, and about a decade later, in Hong Kong. Males and the aged are at a higher risk of developing coronary heart disease. The incidence of this disease is also affected by a number of lifestyle-related risk factors including diet, exercise and others.

Cancer is the most common cause of death in Hong Kong. The number of cancer cases has been increasing steadily, with over 21 000 new cases in the year 2000, and an annual increment of about 2%. There are two major causes for this increase. First and the foremost is the ageing population, and old age is the single important risk factor in developing cancer. The second is the westernized lifestyle in Hong Kong.

Unlike coronary heart disease and cancer, diabetes mellitus is not a common cause of death. However, it is increasingly common among the younger generations of Hong Kong in recent years. Like the other two diseases, diabetes mellitus is also related to lifestyle factors.

To reduce the incidence of coronary heart disease, common cancers and diabetes mellitus and the mortality from these diseases, public health strategies are designed based on the prevalence (i.e. how common they are) of the various factors in the community.

b. In terms of disease control, why is it important to distinguish between lifestyle-related and lifestyle-unrelated risk factors? (lines 7-9) (2)

c. Give ***two*** reasons to explain why old age is the single most important risk factor for the development of cancer. (line 13) (2)

d. Some viral infections are found to be related to the development of certain cancers. Give ***one*** example of such cancers that is common in Hong Kong. Suggest ***two*** preventive measures that individuals can take to protect themselves from such viral infection. (3)

e. Some people believe that diabetes mellitus is caused by excessive intake of sugary food Discuss whether this idea is valid based on your knowledge of the two different types of diabetes mellitus. (4)

AL - 2006 1C

13. Read the following passage and then answer the questions that follow.

Infectious diseases: treatment and control

Up till the beginning of the last century, there was no proper treatment for infectious diseases and many people died of infections that can be easily treated today. The major breakthrough in the treatment of infectious diseases came with the discovery of antibiotics. In 1928, A. Fleming discovered the first antibiotic, penicillin, which is produced by a fungus. Since then, other types of antibiotics produced by other microorganisms were discovered. During the Second World War, many bacterial diseases were effectively treated by using antibiotics. As a result, people predicted that these diseases would not be a problem anymore for humans. However, this prediction has not come true.

During the 1960s, many prisoners in the former Soviet Union developed tuberculosis. This lung disease is caused by the bacterium *Mycobacterium tuberculosis* and transmitted in a similar way as influenza. Due to the crowded conditions in the prison, tuberculosis developed quickly and widely among the prisoners. Even worse was that the antibiotics that used to work well in controlling tuberculosis became ineffective, causing death of the diseased prisoners. Some years later, the same antibiotics were also found ineffective in treating tuberculosis in people in New York City, USA. The bacteria in these people were identical to those found in the prisoners in the Soviet Union.

Even today, with the development of many more types of antibiotics, bacterial diseases still pose a serious problem to human health. It is now known that indiscriminate use of antibiotics has resulted in the loss of their effectiveness in treating diseases. The medical profession thus calls for concerted effort from individuals in the community to help slow down the loss of the effectiveness of antibiotics.

Apart from using antibiotics, vaccination is also an effective alternative for controlling the outbreak of infectious diseases. For example, vaccination against influenza (flu) is recommended for people every year before the onset of the flu season. Since flu can be caused by a variety of flu viral strains, the World Health Organization (WHO) has set up a network to collect samples from flu patients around the world and to analyse the strains of the flu viruses. Based on the data collected, the WHO will predict the prevalent viral strains and then recommend annually the combination of the flu vaccines in the coming flu season.

(b) Explain why the crowded conditions in the prison led to the quick and wide spread of tuberculosis among the prisoners in the Soviet Union. (lines 11-12) (2)

(c) Antibiotics could control tuberculosis well in the past but subsequently failed to cure the diseased prisoners and eventually lost its effectiveness. Account for this. (lines 12-15) (4)

(e) Suggest ***two*** ways in which individuals can contribute to slowing down the loss of effectiveness of antibiotics in treating diseases in the community. Support your answer with biological rationales. (lines 19-21) (4)

(f) The use of antibiotics and vaccination are possible means of disease control. Give ***two*** differences in the principles of these two means in dealing with infectious diseases. (4)

(g) Suggest ***two*** reasons why the combination of the flu vaccines has to be reviewed and determined regularly. (lines 27-28) (2)

AL - 2009 1A

4. Select the appropriate description listed in Column 2 that matches with the cell type given in Column 1. Put the appropriate letter in the space provided. (4 marks)

Column 1		Column 2
B cell	_____	A. Contains a lot of lysosomes
T cell	_____	B. Kills own body cells that display foreign antigens on their surface
Phagocyte	_____	C. Is primarily responsible for the humoral immune response
Memory cell	_____	D. Can pass through the placenta and confer natural immunity to the foetus
		E. Proliferates rapidly upon second exposure to the same antigen

AL - 2010 2A

2. In recent years cancer has emerged as a major life-threatening disease in Hong Kong. It begins with a group of cells that display uncontrolled cell division. A lot of research and resources have been dedicated to the development of various cancer treatments to save the lives of cancer patients.

(a) Some cancers are treated by administering ionising radiation to kill cancer cells in the affected area. Suggest two harmful effects of this treatment on the cancer patients. (2)

(b) (iv) These anticancer drugs are not specific to cancer cells but harm all rapidly dividing cells. Therefore, cancer patients receiving chemotherapy often experience various side effects of the drugs. Suggest three cell types that are more susceptible to anticancer drugs. (3)

(c) The incidence of cancer is higher in the older age group. Suggest two reasons for this. (2)

(d) In some lung cancer patients, there is excessive accumulation of fluid in the alveoli. These patients will suffer from shortness of breath. What is the physiological basis of this symptom? (5)

DSE - 2012 1B

1. For each type of the blood cells listed in column 1, select from column 2 ***one*** phrase that correctly describes its function. Put the appropriate letter in the space provided. (3 marks)

Column 1		*Column 2*
Lymphocytes	___	A. Involved in blood clotting
Blood platelets	___	B. Involved in oxygen transport
Red blood cells	___	C. Involved in antibody production
		D. Involved in phagocytosis
		E. Involved in transporting hormones

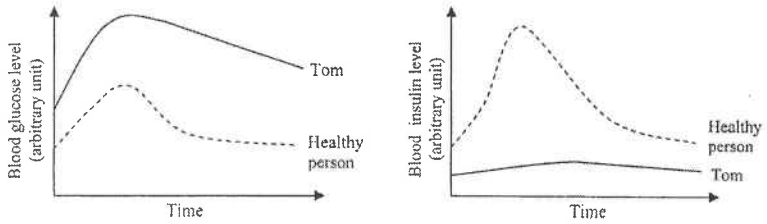
DSE - 2012 1B

2. Dengue Fever is a vector borne disease transmitted by mosquitoes. The table below shows two methods adopted by the Government to break the transmission link of this disease. Complete the table below to show how each method works and comment on its advantage ***or*** disadvantage. (4 marks)

Method	How it works	Comment (advantage or disadvantage)
Spraying of pesticides or larvicidal oil around mosquito's habitat		
Clearance of accumulated water in a neighbourhood		

DSE-2012 1B

7. Tom suffers from diabetes. His doctor asked him to drink, after overnight fasting, a large volume of a glucose solution. After that, blood samples were taken at regular time intervals, to measure insulin and glucose contents. The following graphs show the changes in Tom's blood glucose level and blood insulin level after the test, and those of a healthy person:



(a) Which type of diabetes does Tom suffer from? Explain your answer. (4 marks)

(b) Explain the difference in blood glucose response to the oral consumption of glucose solution between Tom and the healthy person. (3 marks)

(c) What medical treatment should Tom be given? (1 mark)

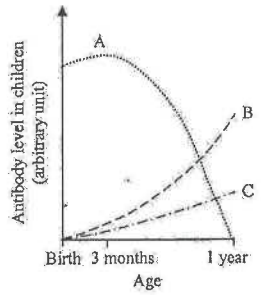
HKDSE - 2013 1B

9. (a) The following graph shows the change in levels of antibodies in children's bodies:

(A) antibodies from mother

(B) children's own antibodies with vaccination

(C) children's own antibodies without vaccination



(i) State the types of immunity resulting from A, B and C. (3 marks)

(ii) Suggest two possible ways that newborns can acquire antibodies from their mother. (2 marks)

(b) Explain why children who have been vaccinated against diseases are better protected than those who have not. (4 marks)

HKDSE - 2014 1B

9. Table I shows the number of deaths in Hong Kong caused by certain diseases. The deaths are categorised according to sex and age.

Table I

Cause of death	Sex	Age group						
		All ages	0	1-4	5-14	15-44	45-64	≥ 65
Heart disease	Male	3352	1	2	2	104	679	2564
	Female	2981	2	2	0	20	146	2811
Diabetes mellitus	Male	213	0	0	0	2	43	168
	Female	246	0	0	0	10	19	217
Colon cancer	Male	725	0	0	0	16	177	532
	Female	627	0	0	0	8	131	488

(a) Rank the diseases in the descending order of mortality (death rate). (1 mark)

(b) From the data above, generalize a trend of mortality that is exhibited by all the diseases. (1 mark)

(c) Table II shows the relative proportions of males and females in the above table who had particular lifestyles:

Table II

Lifestyle	Male	Female
Smoking daily	78.9%	21.1%
Never smoked	36.9%	63.1%
≥ 4 servings of processed meat per week	57.7%	42.3%

From the following diseases, explain how these lifestyles of the males and females are related to the number of deaths in Table I.

Heart disease (3 marks)

Colon cancer (3 marks)

HKDSE – 2016 1B

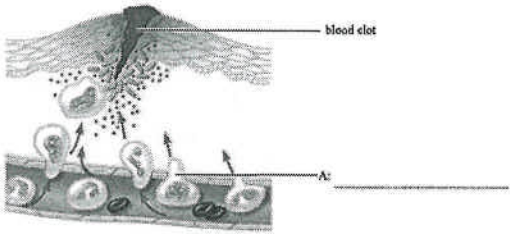
6. (a) Kitty and Karen are identical twins. Kitty has preferred meats to vegetables in her diet since her childhood. Kitty suffered from colon cancer at age 35 while Karen had the same disease 10 years later.

(i) Why did both sisters suffer from colon cancer? (1 mark)

(ii) Why did the disease occur at different ages? (1 mark)

(b) Give two other lifestyles that increase the risk of suffering from cancer. (2 marks)

7. The diagram below shows a site of injured skin exhibiting an inflammatory response:



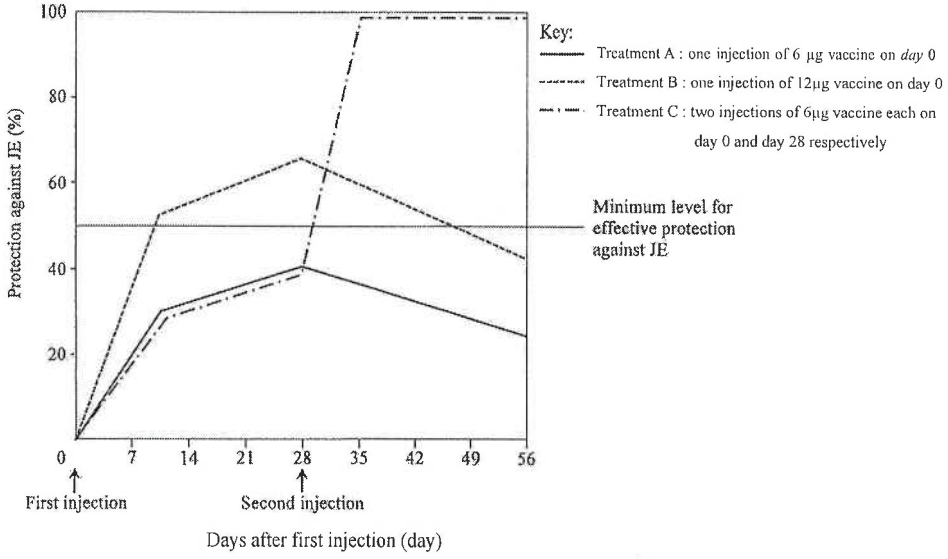
(a) Label the type of white blood cell represented by cell A in the above diagram.(1 mark)

(b) Explain why the tissue exhibiting the inflammatory response usually shows symptoms such as redness, swelling and pain. (3 marks)

(c) Cell A will present the antigens of the invading pathogens to the lymphocytes. Describe what will happen subsequently. (3 marks)

HKDSE - 2017 1B

9. Japanese encephalitis (JE) is an inflammation of the brain caused by a viral infection. Scientists have developed a vaccine against the JE virus. In a study of the effectiveness of the vaccine, three groups of healthy people received different vaccination treatments and the level of protection against JE was monitored over a period of time. The results are shown in the graph below:



a. What is the vector for transmitting the JE virus? (1 mark)

b. For treatment C, explain why there is a sharp rise in protection against JE from day 28 to day 35. (4 marks)

c. Give ***one*** more benefit of treatment C. (1 mark)

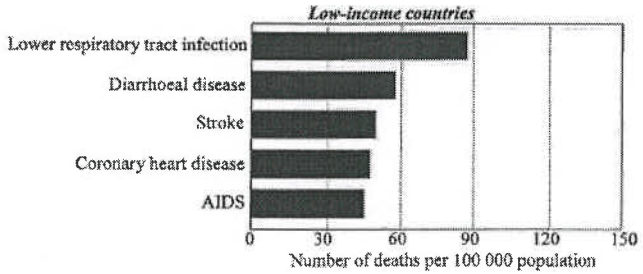
d. Mathew plans to visit a country with many JE cases in 10 days and will stay there for 15 days.

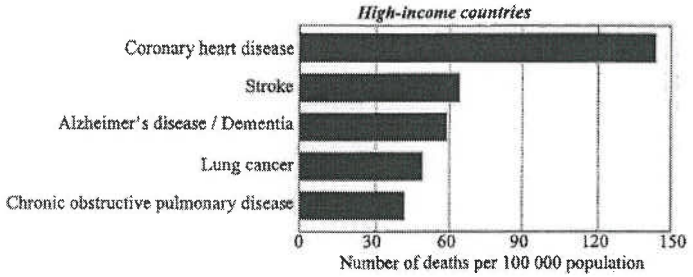
i. With reference to the graph, which vaccination treatment (A, B or C) should he receive at this moment? Explain your answer. (2 marks)

ii. As a responsible citizen, Mathew will continue to use repellant as a precaution for two weeks after he is back from that country. Suggest a rationale for this precaution. (1 mark)

HKDSE - 2018 1B

4. The bar chart below show the top five diseases that caused death in low-income countries and high-income countries respectively in the year 2015:





(a) With reference to the bar charts, which countries(low-income or high-income) have more infectious diseases as the top five diseases that caused death? (1 mark)

(b) Suggest *two* reasons to account for the phenomenon stated in (a). (2 marks)

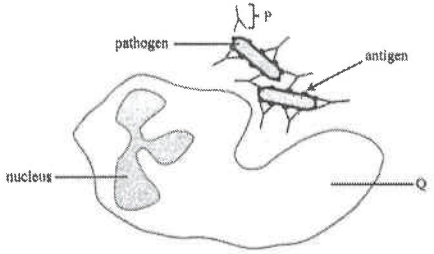
(c) Coronary heart disease is the top cause of death in high-income countries. Explain how *one* of the lifestyle habits in high-income countries is related to coronary heart disease. (4 marks)

HKDSE - 2019 1B

1. (a) Physical and chemical barriers are the first line of defence in the human body. Select from Column II *all* correct example(s) that belong(s) to the two types of barriers in Column I and put the letter(s) in the spaces provided. (2 marks)

Column I		*Column II*
(i)	physical barrier _____	A. skin
		B. tear
		C. antibody
(ii)	chemical barrier _____	D. blood clot
		E. gastric juice

(b) The diagram below shows the process of phagocytosis. Q is a phagocyte while P is a protein molecule produced by a type of lymphocyte.



Describe the function of P in phagocytosis. (3 marks)

HKDSE - 2020 1B

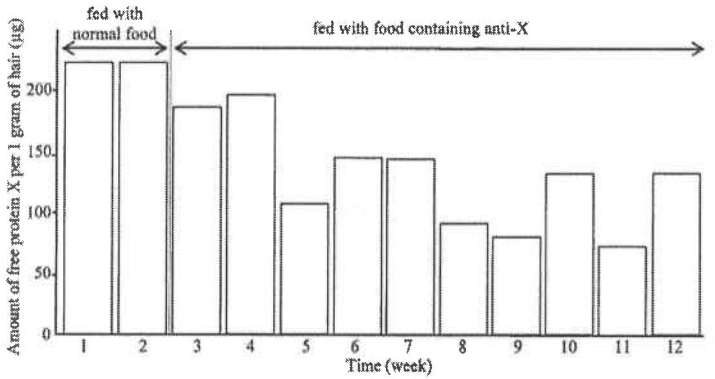
8. Some people suffer from sneezing and coughing when there are cats nearby. These unwanted immune responses, known as allergies, are caused by a protein X secreted by cats' salivary and sebaceous glands. When cats lick their body surface, this protein X is spread to their hair. Protein X can accumulate in their living environment over time.

(a) Recent research shows that the amount of free protein X on cats' hair can be reduced by adding antibodies against protein X (anti-X) to cat food.

(i) Why can anti-X reduce the amount of free protein X on cats' hair? (1 mark)

(ii) There are no proteases in the saliva of cats. Explain why this is important for the success of this method of reducing free protein X. (1 mark)

8. (b) In the research, a group of domestic cats were fed with normal cat food for 2 weeks, followed by cat food containing anti-X for 10 weeks. The amount of free protein X found on their hair during the research is shown in the bar chart below:



(i) Research team member A thought anti-X was effective in reducing the amount of free protein X on cats' hair while team member B thought anti-X was not effective. Based on the bar chart, give ***one*** reason to support team member A and ***another*** reason to support team member B. (2 marks)

Supporting reason for team member A:

Supporting reason for team member B:

(ii) How would you modify the research to confirm whether anti-X in cat food is effective in reducing the amount of free protein X on cats' hair? (2 marks)

(c) Based on the information in the introductory paragraph of this question, suggest *two* limitations of this approach to reducing allergies caused by cats. (2 marks)

CDSE - 2021 1B

6. Pathogen X is a pathogen that infects humans. Research has discovered an antigen Y present on the surface of pathogen X. Using recombinant DNA technology, antigen Y can be produced and serves as a vaccine to induce immunity against pathogen X.

(a) Explain how the injection of antigen Y can induce immunity against pathogen X. (4 marks)

Past Papers Marking Scheme – Health and diseases

CE - 2003 Q.4 (c)

(i) The antigen in the cholera vaccine 1
stimulates specific white blood cells to produce antibody 1
resulting in the rise in antibody level

(ii) For the second injection, the rise in antibody level occurs earlier,
the rise in antibody level is faster
and the peak of the antibody is higher any two 1,1
This is because as a result of the first injection, certain white blood cell will develop
a memory for the antigen 1
When the same antigen enters the body in the second injection, 1
the white blood cells will produce a large amount of antibodies within a short time 1

(iii) Cook the seafood thoroughly 1
Irradiate seawater used in fish tanks with UV light 1
(accept other reasonable answers)

CE- 2004 Q.1 (c)

(i) Oxygen in air dissolves in the water film 1
so that it can diffuse readily through the wall of the air sac into the blood capillary 1

(ii) The accumulation of fluid increases the distance for diffusion / reduces the surface area for dissolving oxygen 1
thereby decreases the rate of diffusion of dissolved O_2 into the blood capillaries 1
Thus the oxygen content of the blood decreases / becomes lower than normal 1

(iii) The antigen of the SARS virus 1
stimulates the white blood cells of the patient to produce the specific antibodies 1

(iv) injection of the weakened virus / the antigen into the body 1
This will stimulate the white blood cells to develop memory for the antigen 1
When the same virus enters the body, 1
a large amount of antibodies can be produced rapidly 1
to kill the virus

CE - 2005 Q.9 (a)

(i) 0.5 to 4 hour 1
Blood glucose is filtered into the kidney tubule 1
In this period, the glucose level in the glomerular filtrate is higher than the upper limit for complete reabsorption of glucose 1
so some glucose will be left in the glomerular filtrate / cannot be reabsorbed and excreted in the urine 1

(ii) Pancreas 1

(iii) Less side effects
More effective in action
Insulin produced from genetically modified bacteria is cheaper and in greater supply
(accept other reasonable answers) any two 1,1

(iv) (1) glucagon 1
(2) Glucagon will stimulate the conversion of glycogen in liver cells to glucose 1

CE- 2008 Q.8 (b)

(b) (i) Diabetic patients lack insulin / do not have enough insulin in their blood 1
and hence the liver fails to convert glucose into glycogen for storage ... 1
During intense exercise, blood glucose is consumed for muscle activities / more blood glucose is consumed 1
The blood glucose level drops continuously without replenishment from the glycogen stored 1

(ii) (1) It takes time for starchy food to be digested before absorption 1
As a result, a small amount of glucose is absorbed gradually 1
The fluctuation of blood glucose level is less / blood glucose level will not increase too fast after a normal meal 1

(2) Sugar is easily digested / absorbable 1
Blood glucose level can be raised immediately / quickly / Faster to alleviate the symptoms of hypoglycaemia 1

CE - 2009 Q.6

(a) Mosquito is the vector for transmitting dengue fever 1

(b) The mosquito population increased with the monthly mean temperature 1
This shows that high temperature favours breeding of mosquito 1

(c) (i) June and July 1

(ii) The breeding period of mosquitoes will be longer / The number of months with mosquito population above 20 arbitrary units would increase 1
The population of mosquitoes will be larger 1
This increases the risk of the transmission of dengue fever 1

(iii) Any one of the following:
- wearing clothes of light colour / clothes with long sleeves 1
- using insect repellent

CE- 2010 Q.8 (a)

8. (a) (i) Antigens/ dead viruses in vaccine are recognized by white blood cells (1)
Memory cells for these antigens are formed (1)
When they encounter the same viruses/ antigens again (1)
they will produce large amount of antibodies (and phagocytes)/ a quicker immune response (1)

(ii) Because they have relatively poor resistance to infectious diseases or influenza/ more difficult to recover from diseases/ relatively weak immunity (1)

(iii) Due to the inhibition of beating of cilia, smoking reduces the efficiency of removal of influenza virus (1)
trapped in the mucus on the respiratory tract (1)

(iv) The virus will form new strain (with new surface antigens) easily (1)
Memory cells developed previously become ineffective against the new strain/ the existing population does not have the immunity against the new strain/ existing vaccine becomes ineffective (1)

AL - 2005 1A

3. a. the intake of contaminated food / water
b. summer / hot
c & d cooking food / boiling drinking water thoroughly / washing hands after going to toilets / proper disposal of sewage / proper treatment of drinking water / vaccination

AL - 2005 1C

12. (b)
- lifestyle factors are those that are under the control of individuals (1) / individuals can make efforts to rectify / avoid; 2
or non-lifestyle factors are inborn (1) / those that an individual can do nothing to change
- regular exercise / balanced diet / medication for disease control after distinguishing the two factors (1)

(c)

Concept for mark award:
- decrease in body immunity to destroy / remove cancerous cell (1) 2
- prolonged exposure to environmental carcinogen / cumulative effect of carcinogens (1)

- decline in immune response by the body / to remove cancerous cells (1) (accept other reasonable alternatives) 2
- environmental carcinogens have a longer time to act as one ages, and hence have a higher chance to cause cancer / cumulative effect of carcinogens as one ages (1)

(d)

Concept for mark award:
- Name of disease (1) (have to be viral induced and common in Hong Kong) 1 +

2 Measures
- immunization / vaccination, if applicable to the disease named (1) max. 2
- prevent the transmission of the virus causing the named disease (1-2)

- liver cancer (1) 1 +
- immunization / vaccination against hepatitis B virus (1) max. 2
- take safety measures to prevent infection by blood (1), safe sex by wearing condom (1), avoid sharing needles (1)

(e)

Concept for mark award:
- agree that excessive sugary food will lead to non-insulin-dependent diabetes mellitus (1), and why (1) 4
- disagree, that is excessive intake of sugary food will not lead to insulin-dependent diabetes (1), and why (1)

- too much sugary food will lead to obesity (1) / overweight (or other reasonable alternatives), increases risk of non-insulin-dependent diabetes mellitus (type II) (1) 4
- sugary food will not lead to insulin-dependent diabetes mellitus (type I) (1) because it is due to autoimmune response (1) / viral infection affecting the pancreas / insufficient secretion of insulin

Bonus: apart from sugary food, high energy food / food rich in carbohydrate + bonus = 1
also lead to obesity (1)

AL - 2006 1C

13. (b) • tuberculosis is transmitted through air (1) / droplets 2
• the bacteria would be transmitted easily over a short distance (1) from infected individuals to uninfected individuals in the crowded prison / uninfected individuals have a high chance of exposure to the bacteria from infected individuals in the crowded prison

(c) • in the past, the predominant population of *Mycobacterium tuberculosis* was sensitive to antibiotics (1), so antibiotics were effective in controlling tuberculosis max. 4
• there were variations in the bacterial resistance against antibiotics (1)
• excessive use of antibiotics eliminated the sensitive strains (1) / selected for the resistant strains
• resistant strains multiplied (1) and became the predominant populations (1), hence antibiotics became no longer effective

(e)

Concept for mark award: 4
Action to take (1) + rationale (1) any two 2 × (1 + 1)

Action	Rationale	
• take antibiotics only when necessary (1) / when one's immune response cannot cope with the bacterial infection / avoid using antibiotics for viral diseases	• to reduce the exposure of the pathogens to the antibiotics (1)	1 + 1
• complete the whole course of antibiotics prescribed (1)	• to let the antibiotics eradicate the bacterial population in the body leaving no strains to propagate (1)	1 + 1
• take precautions against being infected (1) / spreading one's infection / improve sanitation	• to reduce the chance of using antibiotics (1) / to reduce the chance of spreading the resistant gene	1 + 1

4

(f)

Concept for mark award: 4
Contrast on any ***two*** of the following:
• nature of the control measure
• agent for killing pathogens / action of antibiotics vs action of vaccine
• scope of efficacy (the types of diseases being controlled)

e.g. any two sets

Antibiotics	Vaccination	
• curative measure (1) / for treatment	• preventive measure (1) / for prevention / controlling the spread of diseases	1 + 1
• kill pathogens directly (1)	• stimulate the development of immunological memory (1) / pathogen is killed by T-cells / antibiotics produced by human body	1 + 1
• effective against bacterial diseases only (1)	• effective against both bacterial and viral diseases (1)	1 + 1

4

(g) • the flu virus may undergo mutation frequently (1) to form new strains
• the epidemic strains may vary in different seasons (1)

AL - 2009 1A

4. (a) C (b) B (c) A (d) E (1) x 4

AL - 2010 2A

2 (a)
· it kills normal cells near the affected area (1) (2)
· it may induce mutation of the nearby normal cells (1)

(b) (iv) Any *three* of the following:
· cells of intestinal lining (1) / epithelial cells of the intestinal lining (3)
· cells of the hair follicle responsible for the growth of hair (1)
· cells of bone marrow that responsible for producing blood cells (1)
· germ cells in testes (1) (not sperm)
· lymphocytes (1)

(c) Any two of the following:
· exposure to carcinogenic substances for a longer time / accumulate more carcinogenic chemicals (2)
· the mutations of genes have accumulated to a level that cancer develops
· a weaker autocorrection mechanism / immune system

(d)

Concept for mark award:
· slow diffusion rate in liquid medium (1) leads to decrease in the efficiency of gas exchange (1) (5)
· elevated CO_2 conc. in blood (1) and its subsequent effect on breathing rate (2)

e.g.
· gas diffusion in liquid medium is slower than that in gas medium (1) / this reduces the surface area for gas exchange (5)
· efficiency of gas exchange decreases (1)
· carbon dioxide accumulates in blood (1) / less oxygen is taken up into the blood
· chemoreceptors at the medulla are stimulated (1) / carotid body / aortic body
· nerve impulses from medulle are sent to increase the breathing rate (1) / inflammation (1) / effector (1)

DSE-2012 1B

1. C (1)
   A (1)
   B (1)

DSE-2012 1B

2.

Method	*How it works*	*Comment (advantage or disadvantage)*	
Spraying of pesticides or larvicidal oil to mosquito's habitat	Directly kill the larvae / adult mosquitoes (1) so that they cannot serve as vector	Pros: quickly put mosquito population down in short term (1) Cons: mosquitoes may develop resistance to the pesticides (1) / environmental contamination when pesticides leak to water bodies / pesticides are toxic to humans	1,1
Clearance of accumulated water in the neighbourhood	Eradicate the breeding places of mosquitoes (1)	Pros: does not have adverse impacts on environment (1) Cons: it is vritually impossible to clear up all stagnant water (1)	1,1

DSE-2012 1B

7. (a) • despite the high blood glucose level detected in his blood, his fasting blood insulin level was lower than that of the healthy person (1) (1)
   • although there is an increase in blood glucose level, the insulin level only shows little change (1) (1)
   • this shows that Tom failed to produce the normal amount of insulin (1) (1)
   • therefore, Tom suffered from insulin-dependent diabetes (1) / type I diabetes (1)

   (b) • with insufficient insulin, his body cells will not take up extra glucose from the blood as efficiently as the healthy person (1)
   • as a result, the blood glucose concentration rised to a higher level (1) after glucose consumption
   • and remains high for a longer time / decreases slower than the healthy person (1) (3)
   Remarks: conversion of glucose to glycogen by insulin is not acceptable

   (c) • by injection of insulin (1) / aerosal spray of insulin applied to nasal cavity (1)

DSE-2013 1B

9. (a) (i) A: (Natural) passive immunity (1)
   B: (Artificial) active immunity (1)
   C: (Natural) active immunity (1) (3)

   (ii) • some antibodies in the maternal blood pass through the placenta and enter into the foetal blood (1)
   • some maternal antibodies in the mother's milk pass to the newborn via breast feeding (1) (2)

   (b) • vaccine contains antigens (1)
   • which stimulate the immune system to produce memory cells for that particular antigens (1)
   • on the 2nd exposure to the same antigen (1)
   • these memory cells are capable of producing a large amount of antibodies (1) (4)
   therefore, child with vaccination has a better protection

DSE-20141B

9. (a) heart diseases > colon cancer > diabetes mellitus (1) (1)

   (b) number of death increases with age groups (1) / age (1)

   (c) Heart disease:
   • heart disease kills more male than females (1)
   • more male were daily smokers (1)
   • nicotine of cigarette smoke increases the chance of blocking the blood vessel (1) (3)
   Colon cancer:
   • colon cancer kills more males than females (1)
   • more male consumer less fruits and vegetables / more processed food (1)
   • vegetables stimulate peristalsis and removal of faeces or contain antioxidant to prevent DNA from the attack of free radicals / processed food contains chemicals that may stimulate mutations (1) of colon epithelium (3)

8 marks

DSE – 2016 1B

6. (a) (i) Karen is genetically identical to Kitty, hence they both have the cancer-causing genes 1
   (ii) Kitty's eating habit would trigger the development of colon cancer earlier 1

   (b) Any *two* of the following:
   • Smoking (1)
   • Drinking (1)
   • Stress (1) 2

7. (a) A: phagocyte [accept macrophage /neutrophil; accept plural form] 1

   (b) arterioles [accept blood vessels; NOT accept others, e.g. capillaries] of the tissue with inflammatory response dilate, increasing blood flow to the tissue and makes it red (1)
   permeability of capillary walls [accept blood vessel walls; NOT accept others] increases, thus increasing flow of plasma to the tissue / resulting in the accumulation of tissue fluid and makes it swell (1)
   more tissue fluid presses against nerve endings/ stimulating the pain receptors, giving pain sensation (1)
   Remarks: Three points should be marked separately. 3

   (c) Activity of B-lymphocytes will lead to the production of antibodies against the specific pathogens (1) [B-lymphocytes differentiate^ into plasma cells / memory cells$ (1); plasma cells produce antibodies (1) against the specific pathogens]
   T-lymphocytes will form killer cells to destroy the infected cells (1)
   [T-lymphocytes differentiate^ into killer cells / memory cells$ (1); killer cells destroy the infected cells (1)]
   memory cells will be formed for future immunity (e.g. quicker response in the 2nd attack) (1) [accept enhanced immunity, recognize/memorize the antigen/pathogen]
   $ The concept of differentiation into memory cells will be marked once only
   ^ accept transform/ convert/ change/ form/ turn; not accept stimulate/ activate
   max 3

   (d) Redness: red blood cells/ blood [Not accept blood platelets] flow to injured skin/

bleeding and formation of blood clot at injured area (1)
Swelling: accumulation of tissue fluid/blood/a large amount of white blood cells/ pathogens at the injured skin (1)
Pain: the pain receptors/ nerve endings I sensory neurons are stimulated I injured and give signals to the brain for pain sensation (1)
Remarks:
Three points should be marked separately.
Related knowledge learned from CS Bio:
- *Functions of blood*
- *Formation of tissue fluids*
- *Sensation* 3

HKDSE – 2017 1B

9. (a) • mosquitoes (1) (1)

(b) • memory cells are produced [accept develop/differentiate] when the person has received the first dose of vaccine (1)
• in the second dose, these memory cells encounter thesame antigens[accept that specific antigen, original antigen, antigen encountered before, etc.] (1)
• memory cells differentiate [NOT accept stimulate/activate] into plasma cells / killer cells / specific lymphocytes [accept specific B-cells/ specific T-cells] (1) (4)
• resulting in production of a large amount of antibodies/killer cells [accept T-cells]within a shorter time (1)
leading to the sharp rise in the protection against the infection

(c) • the protective effect [accept level of antibodies/killer cells if mentioned in (b)] does not wear off / remains high (1) from day 35 to 56 (1)

(d) (i) • vaccination treatment B (1) (1+1)
• as it offers protection over the minimum level of effective protection from day 10 [accept day 8/9]to day 47 [accept day 25 to day 49]after administration / for a period which fully covers Mathew's trip (1)
[no mark will be given with wrong choice of treatment]
(ii) • even if he has contracted JE during the trip, the precaution can help prevent / reduce the risk of transmission of the virus(1) to other people as the insect repellant prevents mosquito bite. (1)

9 marks

HKDSE – 2018 1B

4. (a) • low-income countries (1) (1)

(b) Any *two* of the following:
• poor public / personal hygienic conditions led to easy spreading of infectious diseases (1)
• poor healthcare systems failed to treat patients at critical time (1) (2)
• poor income could not afford the medical costs for treating infectious diseases (1)

(c) • consumption of high calories food / fatty food / lack of exercise (1)
• increase the risk of plaque formation / deposition of cholesterol / fat in coronary arteries (1)

• which leads to narrowing of the lumen of arteries / blockage in arteries / decrease blood flow to the heart (1) (4)
• heart muscles do not have enough nutrients / food and oxygen supply (1), resulting in heart attack

7 marks

HKDSE – 2019 1B

1. (a) (i) A, D (1)
B, E (1) (2)

(b) • P is a type of antibody which attaches to the antigens on the surface of the pathogens (1)
• P binds several pathogens together as a big mass / clumping *[accept agglutination / precipitation]* (1) (3)
• to enhance / facilitate the phagocytosis by Q (1) *[accept further explanation of role of antibody in phagocytosis]*

5 marks