

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

INTEGRATED SCIENCE PAPER 2 (Sample Paper)

Time allowed : 1 hour 30 minutes
This paper must be answered in English

INSTRUCTIONS

1. There are **TWO** sections in the paper, Section A and Section B.
2. Section A contains multiple-choice questions set on the Compulsory Part of the Integrated Science Curriculum. Section B contains questions set on the Elective Part.
3. The weightings of Sections A and B are respectively 15% and 20% of the Subject Mark.
4. You are advised to spend about 35 minutes on Section A and about 55 minutes on Section B.

Instructions for Section A (Multiple-choice questions):

1. Read carefully the instructions on the Answer Sheet. Stick a barcode label and insert the information required in the spaces provided.
2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF SECTION A**' after the last question.
3. All questions carry equal marks.
4. **ANSWER ALL QUESTIONS.** You should use an HB pencil to mark all your answers on the Answer Sheet. Wrong marks must be completely erased.
5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.
6. No marks will be deducted for wrong answers.

Instructions for Section B :

Answer any **TWO** questions. Write your answers in the Answer Book provided.

SECTION A

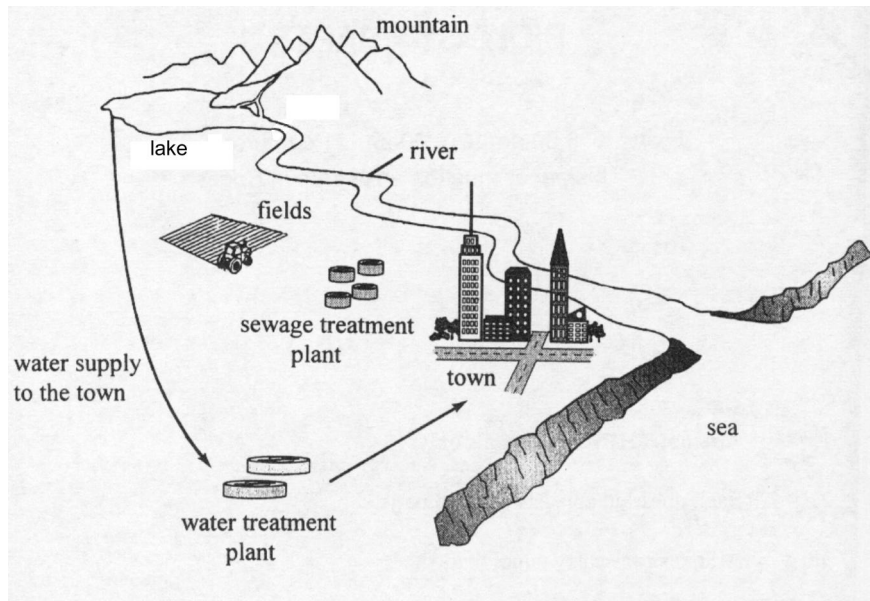
There are 32 questions in this section. Choose the best answer for each question.

1. Which of the following can explain the formation of hydrogen bonds between water molecules ?
 - (1) In a water molecule, the oxygen atom carries lone pairs of electrons.
 - (2) In a water molecule, the O–H bond is highly polarised.
 - (3) A water molecule has a V shape.
 - A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)

2. Which of the following properties of water is NOT related to the presence of hydrogen bonds between water molecules ?
 - A. The density of ice is smaller than that of water.
 - B. Water has a high specific heat capacity.
 - C. Water is a poor conductor of electricity.
 - D. Water has a high surface tension.

3. Which of the following are functions of water in plants ?
 - (1) as raw material for respiration
 - (2) as raw material for photosynthesis
 - (3) as a medium for food transport
 - A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)

4. The diagram below shows a town and its surrounding areas.



Which of the following problems will arise if large scale deforestation is done on the mountain ?

- (1) Less water will be trapped in the lake.
- (2) Flooding will occur more frequently in the low lands.
- (3) The quality of water delivered to the town will become poor.

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

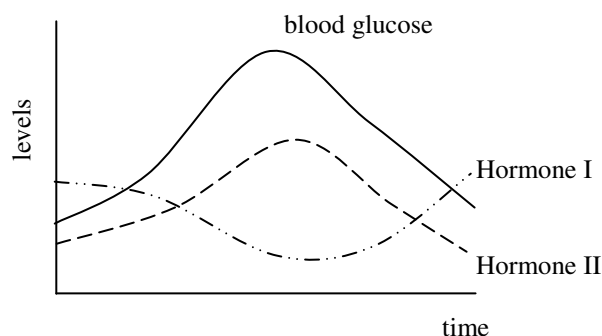
5. In the regulation of body temperature, the skin plays the role of

- (1) a receptor.
- (2) an effector.
- (3) a coordinating centre.

Which of the following combinations is correct ?

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

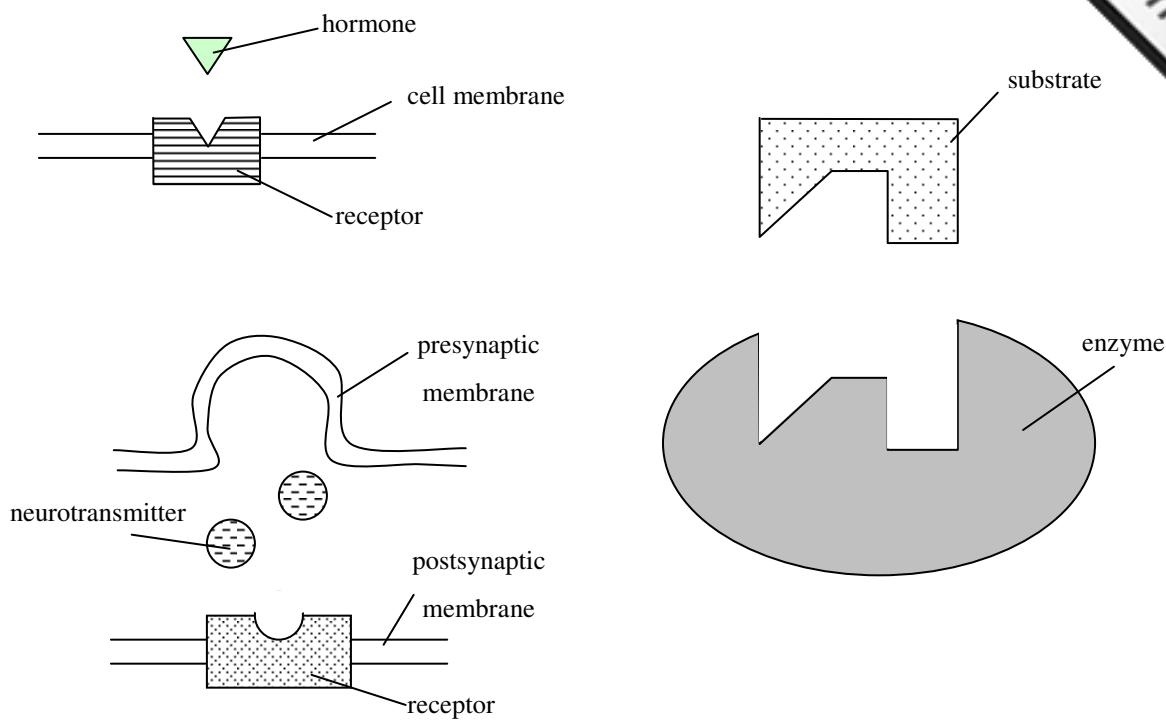
6. The graph below shows the variations of the levels of two pancreatic hormones (I and II) and glucose level in normal human body with time.



Which of the following is correct ?

- A. Hormone I is glucagon. It helps to raise the blood glucose level.
 B. Hormone II is glucagon. It helps to lower the blood glucose level.
 C. Hormone I is insulin. It helps to lower the blood glucose level.
 D. Hormone II is insulin. It helps to raise the blood glucose level.
7. Which of the following shows the pathway of nerve impulses when the body detects a stimulus and produces the sensation ?
- A. sense organ → sensory nerve → white matter of cerebrum → grey matter of cerebrum
 B. sense organ → sensory nerve → grey matter of cerebrum → white matter of cerebrum
 C. sense organ → sensory nerve → white matter of cerebrum → grey matter of cerebrum → sense organ
 D. sense organ → sensory nerve → grey matter of cerebrum → white matter of cerebrum → sense organ

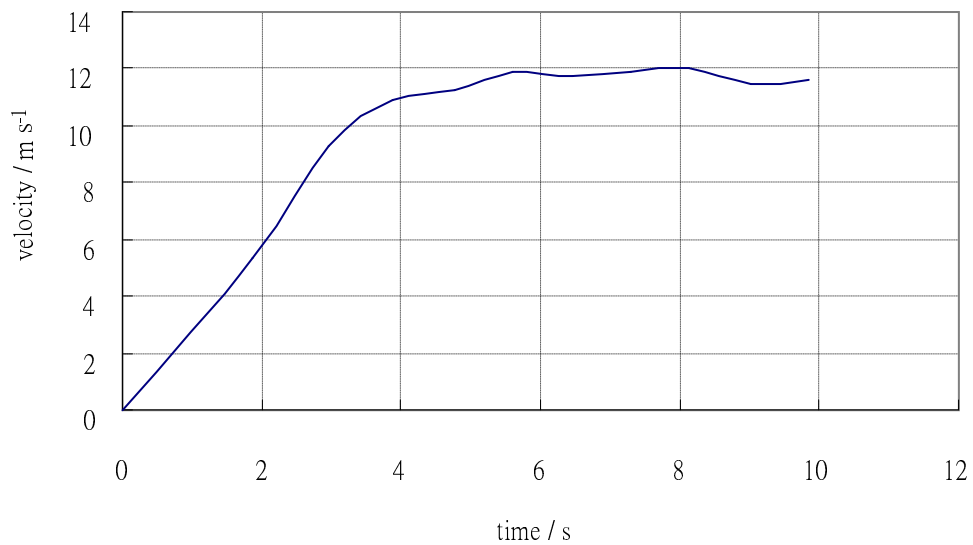
8. The diagrams below show three processes that may happen on the surface of a cell or within a cell.



Which of the following statements about the above processes is correct ?

- A. All of these processes involve lipids.
- B. All of these processes speed up some biochemical reactions.
- C. All of these processes involve the use of ATP.
- D. All of these processes involve the specific binding of one molecule to another molecule.

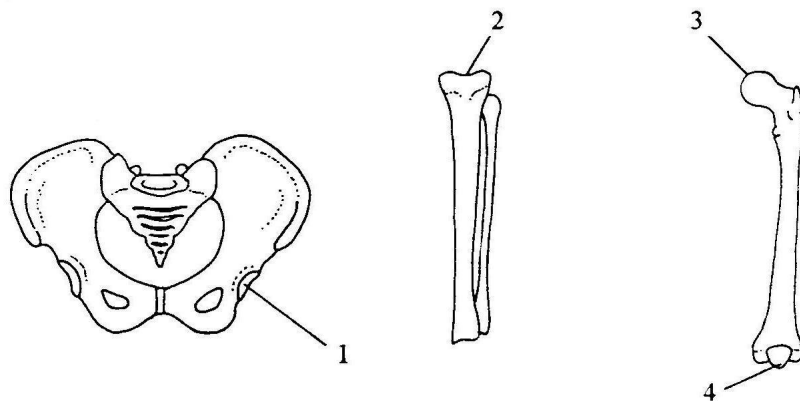
9. The graph below shows the variation of velocity with time of a 100 m sprinter:



Which of the following statements about the graph is correct ?

- A. The acceleration of the sprinter was zero at the start of the race.
- B. The sprinter ran at constant velocity at some point during the race.
- C. Maximum acceleration occurred between 1 s and 2 s.
- D. The average velocity of the sprinter was 12 m s^{-1} .

10. A runner wears a pair of air-cushioned sports shoes. Which of the following descriptions of the function of the air-cushion and its effect on the runner is correct ?
- A. It increases the impact time of the shoes with the ground. This makes the runner feel more comfortable while running as the impact force is reduced.
 - B. It reduces the frictional force between the shoes and the ground. This makes the runner run faster as the forward force of the runner increases.
 - C. It exerts a greater action force on the ground. This makes the runner run faster as the reaction force exerted by the ground on the runner is increased.
 - D. It exerts an upward force on the feet of the runner when the shoes impact on the ground. This allows the runner to spring higher on each pace.
11. The diagrams below show sets of bones of the human skeleton :



A ball and socket joint can be formed between

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

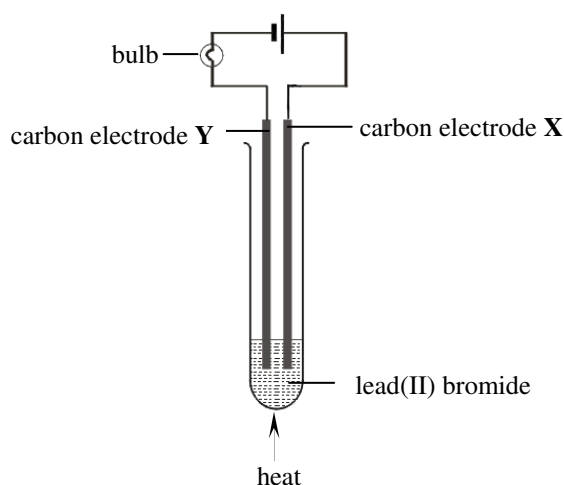
12. Which of the following are possible advantages of exercising regularly ?
- (1) increasing the strength of skeletal muscles
 - (2) increasing the oxygen-carrying capacity of the blood
 - (3) increasing the time taken for the body to respond to a stimulus
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)
13. Dimitri Mendeleev published his Periodic Table in 1869. Which of the following statements about Mendeleev and his Periodic Table is INCORRECT ?
- A. Mendeleev believed that elements react according to certain patterns.
 - B. Mendeleev was able to predict the existence of elements that had not been discovered in his time.
 - C. Mendeleev realised that the chemical properties of elements were related to their electron arrangements.
 - D. Mendeleev noticed some anomalies in his Periodic Table.
14. Consider the information about four atoms/ions, **W**, **X**, **Y** and **Z**, given in the table below :

	W	X	Y	Z
No. of protons	8	8	8	10
No. of electrons	10	10	8	10
No. of neutrons	8	10	10	10

Which of the following statements about the atoms/ions is correct ?

- A. **Y** and **Z** are isotopes.
- B. **W** and **Y** have the same mass.
- C. **X** and **Y** have the same charge.
- D. **W** and **Z** have the same arrangement of electrons.

15. The set-up shown below is used in an experiment and the solid lead(II) bromide is heated until molten.



Which of the following statements concerning the experiment is INCORRECT ?

- A. The bulb lights up.
 - B. A reddish brown gas is liberated at carbon electrode X.
 - C. The experiment should be conducted in a fume cupboard.
 - D. Oxidation occurs at carbon electrode Y.
16. Consider the information given below :

	<u>Substance</u>	<u>Attraction between particles in substance</u>
(1)	helium	van der Waals forces
(2)	diamond	covalent bond
(3)	magnesium oxide	ionic bond

Which of the following combinations is correct ?

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

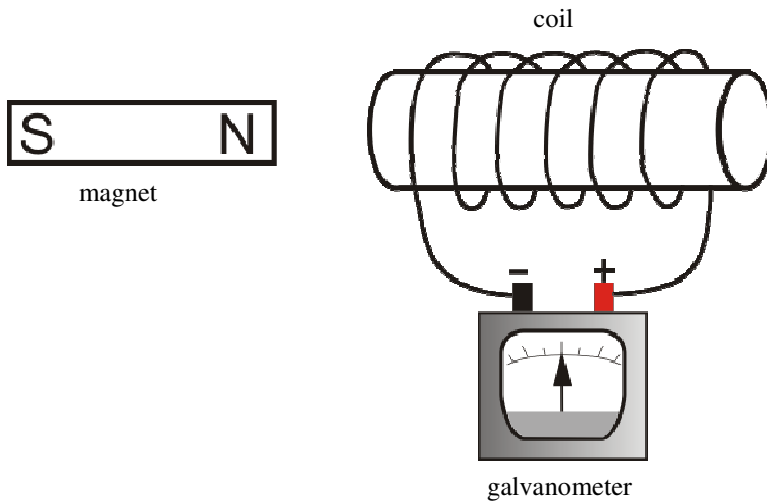
17. Consider the four events listed below :

- (1) Ampere’s investigation of force between parallel current-carrying wires
- (2) Faraday’s discovery of electromagnetic induction
- (3) Oersted’s discovery of magnetic effect of current
- (4) Volta’s discovery of chemical cell

Which of the following represents the correct sequence in the development of electricity and magnetism ?

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

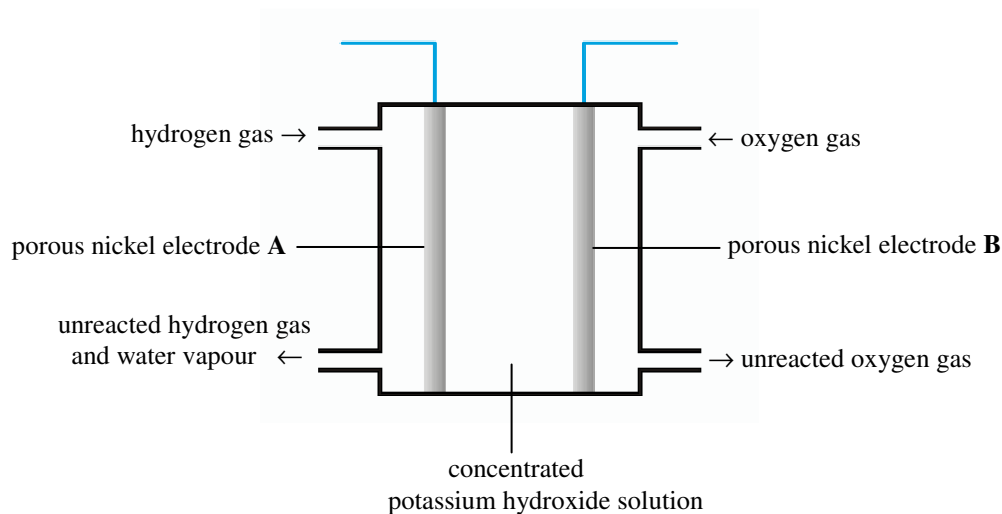
18.



A coil is connected to a galvanometer. A bar magnet is inserted into the coil and allowed to stay inside the coil briefly and then withdrawn. The correct sequence of deflection of the pointer of the galvanometer is

- A. Left → back to zero → left → back to zero
- B. Right → back to zero → right → back to zero
- C. Left → back to zero → right → back to zero
- D. Right → back to zero → left → back to zero

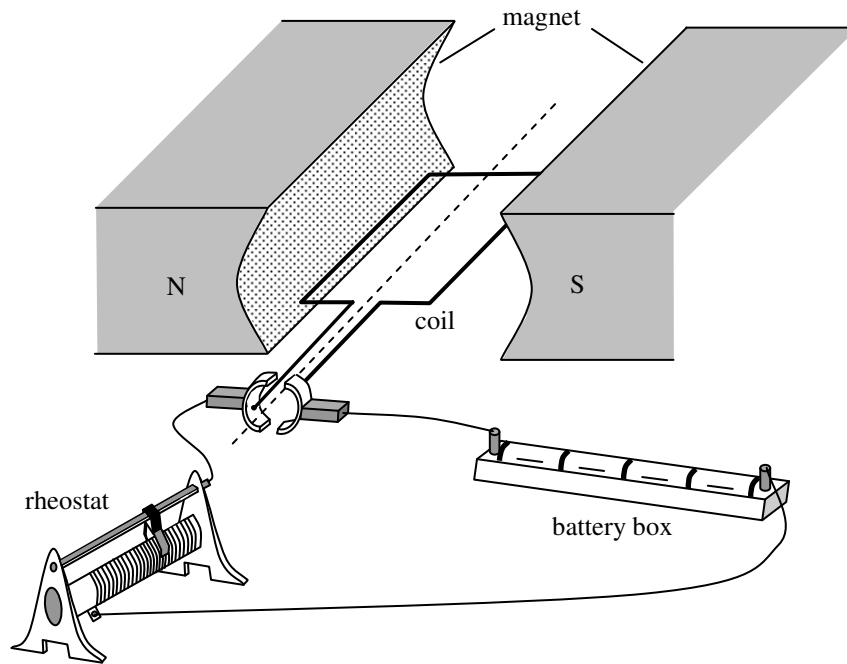
19. A simplified diagram of a hydrogen-oxygen fuel cell is shown below:



Which of the following statements about the fuel cell are correct ?

- (1) Nickel catalyses the reaction of hydrogen and oxygen to give water.
 - (2) Porous nickel electrode **A** is the positive pole.
 - (3) The cell is more efficient than internal combustion engines in converting chemical energy to electrical energy.
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

20.



The above diagram shows a simple motor. Which of the following changes can increase the turning effect of the coil ?

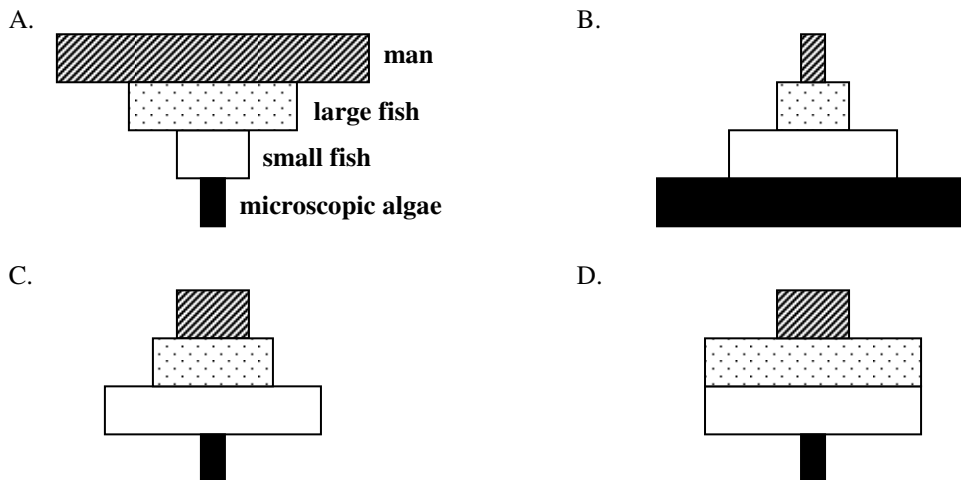
- (1) using a stronger magnet
- (2) reducing the resistance of the rheostat
- (3) using a coil with a greater number of turns

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

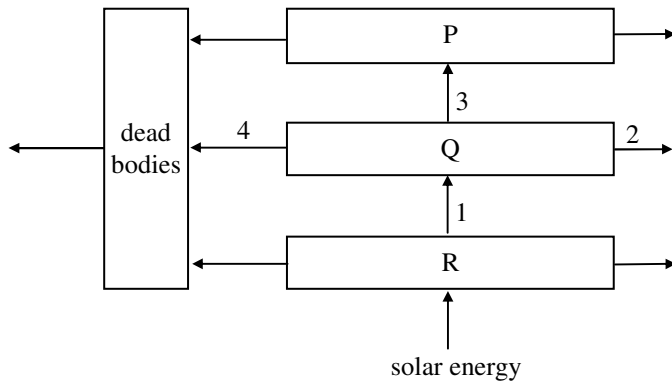
21. Consider the food chain shown below :

microscopic algae → small fish → large fish → man

Industrial waste water containing mercury is discharged into the sea. Which of the following diagrams best represents the amount of mercury in the body of various organisms in the food chain ?



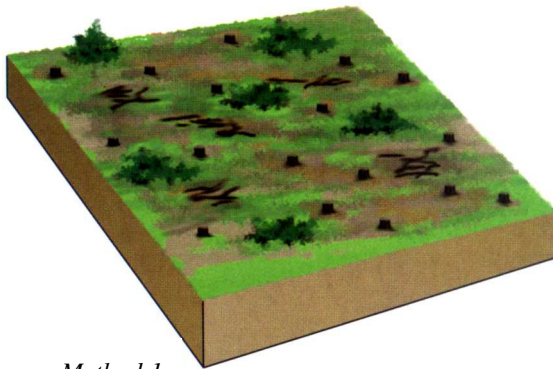
22. The diagram below shows the flow of energy in an ecosystem. P, Q and R represent different levels in the ecosystem.



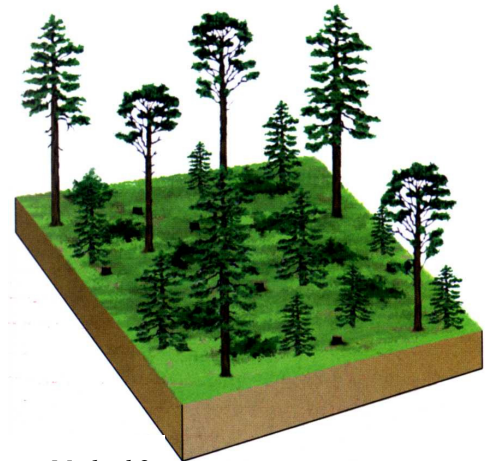
Key: \longrightarrow direction of energy flow

With reference to trophic level Q, the largest amount of energy flow occurs in

- A. 1.
 - B. 2.
 - C. 3.
 - D. 4.
23. The diagrams below show two methods of harvesting timber from a forest. *Method 1* involves cutting all trees in the area. *Method 2* involves cutting most of the trees but leaving some seed-producing trees in the area.



Method 1

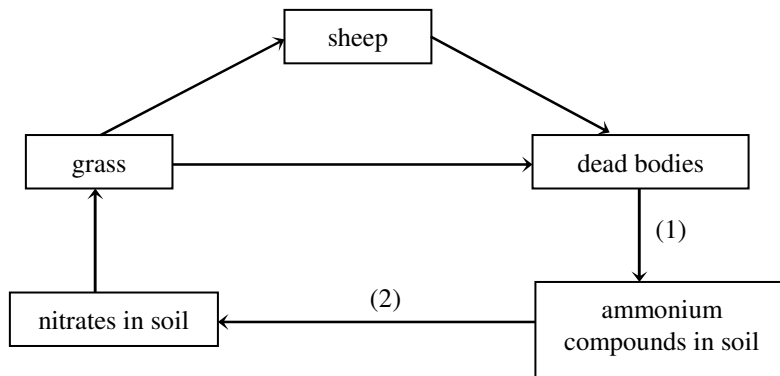


Method 2

Which of the following statements about the two methods of harvesting timber is INCORRECT ?

- A. *Method 1* can have greater yield of timber per hectare than *Method 2*.
- B. The area from *Method 1* will have more serious soil erosion than that from *Method 2*.
- C. Seed-producing trees left in the area can help regenerate the forest.
- D. After certain years of regeneration, the area from *Method 1* will be covered by the same species of trees if there is no human intervention.

24. The diagram below shows how nitrogen can be cycled in an ecosystem :



What are processes (1) and (2) ?

	<u>Process (1)</u>	<u>Process (2)</u>
A.	decomposition	nitrogen fixation
B.	decomposition	nitrification
C.	nitrogen fixation	nitrification
D.	nitrification	nitrogen fixation

25. A solar powered calculator can barely function if it is illuminated by a 100 W filament lamp at a distance of 3 m away. What is the maximum distance from a 60 W filament lamp for this solar powered calculator to function ?

(Assume that there is no other light source around.)

- A. 1.50 m
- B. 1.80 m
- C. 2.32 m
- D. insufficient data for calculation

26. In 1990, the International Commission on Radiological Protection recommended that radiologists should not receive effective dose of radiation more than 20 mSv per year, while the general public should not exceed 1 mSv per year.

Which of the following statements about the dose limits of radiologists and the general public is correct ?

- A. The difference in dose limits is based on the ALARA (as low as reasonably achievable) principle.
- B. Radiologists are professionally trained and can tolerate higher dose of radiation than the general public.
- C. It is safe to expose to radiation as long as the dose limit of 1 mSv per year is not exceeded.
- D. The general public is exposed to a background radiation of about 1mSv per year.

27. Which of the following statements about nuclear power plants is/are correct ?

- (1) If an accident occurs in a nuclear power plant, the reactor would explode like a nuclear bomb.
- (2) The spent fuel rods in the nuclear reactor remain radioactive for thousands of years.
- (3) In normal operation, a nuclear power plant releases cooling water which is radioactive.

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

28. Which of the following statements about the use of a Geiger-Muller counter to measure radioactivity from a source are correct ?

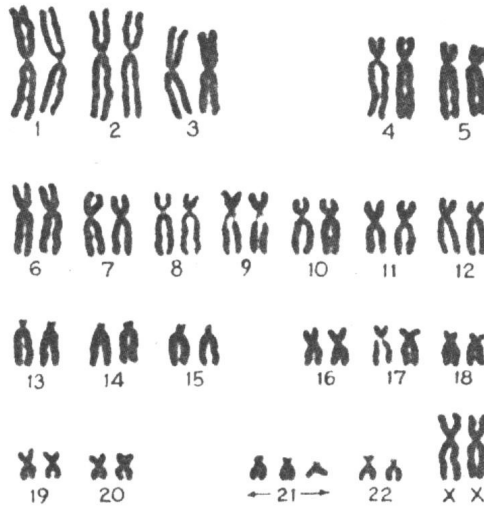
- (1) Use tongs and wear gloves when handling the radioactive source, and thoroughly wash hands after the experiment.
- (2) Run the counter for a short while before taking out the radioactive source from the storage box.
- (3) During the experiment, the use of mobile phones will cause additional radiation recorded by the counter.

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

29. The existence of variations within a population enables

- A. an increase in the mutation rate.
- B. an increase in the population.
- C. the offspring to grow faster.
- D. the survival of the fittest.

30. A person has a genetic abnormality. The diagram below shows the chromosome of one body cell of this person.

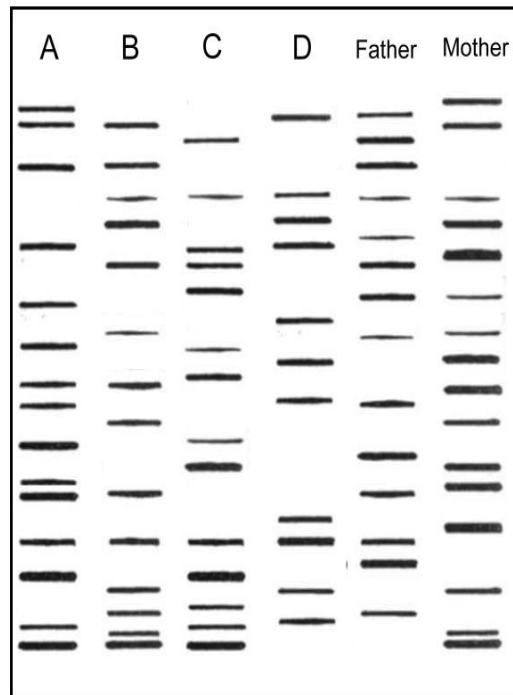


Which of the following statements is/are correct ?

- (1) This person suffers from Down syndrome.
- (2) All the children of this person will have the same abnormality.
- (3) This genetic abnormality is due to gene mutation.

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

31. The diagram below shows the DNA fingerprint of a couple and four children A, B, C and D. Which of these children is most likely to be the child of the couple ?



- A. Child A
 B. Child B
 C. Child C
 D. Child D
32. Which of the following statements about human DNA is correct ?
- (1) It carries genetic information.
 (2) It controls the formation of antibodies.
 (3) In mitosis, a dividing cell contains more DNA than each of the daughter cells.
- A. (1) and (2) only
 B. (1) and (3) only
 C. (2) and (3) only
 D. (1), (2) and (3)

END OF SECTION A

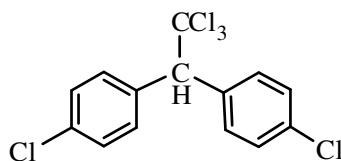
SECTION B

Answer any **TWO** questions. Write your answer in the answer book provided.

1. **Chemistry for World Needs**

- (a) Chlorine is a chemical manufactured million tonnes annually. Much of it is used to disinfect water or is turned into hypochlorite bleach (also known as chlorine bleach) for use in home.
- (i) State the industrial process for the manufacture of chlorine. (1 mark)
- (ii) Chlorine bleach has been widely used as a domestic disinfectant for more than 100 years. State **TWO** precautions when using chlorine bleach as a domestic disinfectant. (2 marks)
- (iii) Both chlorine and ozone are used nowadays to disinfect our drinking water. Compare the advantages and disadvantages of using chlorine and ozone for this purpose. (4 marks)
- (iv) Chlorine was once widely used to manufacture DDT (dichlorodiphenyltrichloroethane) which is an effective insecticide. The use of DDT has been banned in most developed countries. However, it is still used in some countries as an insecticide.

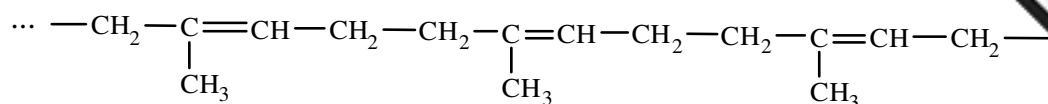
Discuss the pros and cons of using DDT in the agricultural industry.



DDT

(4 marks)

1. (b) Natural rubber is a polymer which is extracted from the latex of the rubber tree. A part of its structure of natural rubber is shown below:



- (i) Draw the repeating unit of natural rubber. (1 mark)
- (ii) In 1839, Charles Goodyear accidentally dropped a mixture of natural rubber and sulphur onto a hot stove. He found that the rubber so obtained had its strength and elasticity significantly improved.
- (I) With the help of appropriate drawing(s), explain why the strength of natural rubber would improve after reaction with sulphur. (2 marks)
- (II) Suggest why the discovery of Charles Goodyear brought him a good fortune. (2 marks)
- (iii)

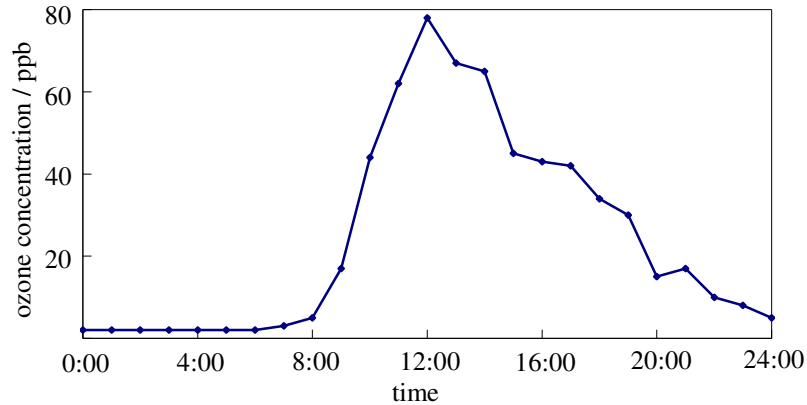
**Incineration
vs
Recycling**

Plastics are polymeric materials commonly used in our daily life. Most of the plastics are made from petroleum fractions. The disposal of the huge volume of plastic wastes has posed a problem to many modern cities. Incineration and recycling are two of the ways suggested by scientists to solve the problem.

Compare the risks and benefits of using incineration and recycling to treat plastic wastes. (4 marks)

2. Energy, Weather and Air Quality

- (a) The graph below shows a 24-hour variation of ozone concentration in the atmosphere of a city with heavy traffic:



Account for the variation of ozone concentration in the atmosphere of the city.

(4 marks)

- (b) Figures 1 (a) and 1 (b) show the weather charts at 8:00 a.m. on 21 and on 22 August 2004 respectively. Figure 2 shows the Air Pollution Index (API) obtained at 8:00 a.m. during the period 20 to 29 August 2004 from the roadside air quality monitoring station at Mongkok, Hong Kong.

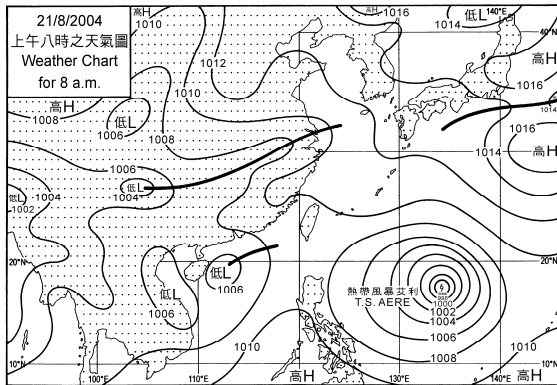


Figure 1 (a) Weather chart at 8:00 a.m. on 21/8/2004

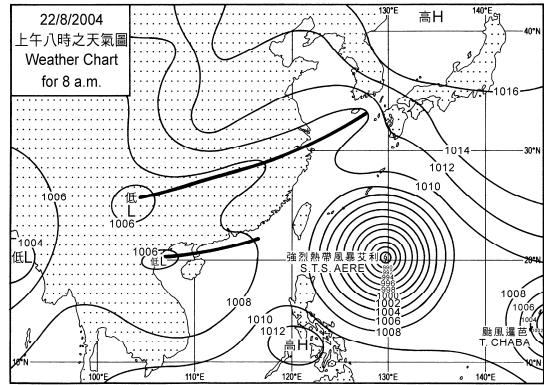


Figure 1 (b) Weather chart at 8:00 a.m. on 22/8/2004

Roadside API at 8:00 am obtained from Mongkok air quality monitoring station (20 - 29 August 2004)

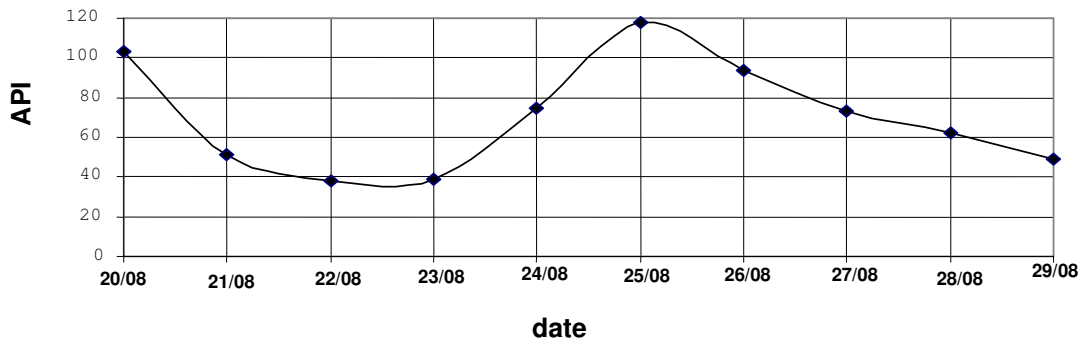


Figure 2

2. (b) (i) What type of weather system was affecting Hong Kong on 22 August 2004? With reference to the weather charts in Figures 1 (a) and 1 (b), explain the decreasing trend of the API from 20 to 22 August 2004 as shown in Figure 2. (3 marks)
- (ii) Tropical cyclone Aere was formed on 21 August 2004 in the west Pacific Ocean. Suggest TWO factors essential for the formation of a tropical cyclone. (2 marks)
- (iii) Explain how a tropical cyclone maintains itself as a self-sustaining system before dissipation upon landing. Hence, suggest why the isobars associated with Aere became denser in Figure 1 (b) when compared with Figure 1 (a). (5 marks)
- (iv) During the period from 23 to 25 August 2004, Aere intensified to a typhoon. It headed for south-eastern China and swept over northern Taiwan, which is hundreds of kilometers from Hong Kong (Figures 3 (a) to 3 (c)). The air quality in Hong Kong became worse with the API reaching a peak on 25 August 2004 (Figure 2).
- (I) With reference to the weather charts in Figures 3 (a) to 3 (c), identify with reason(s) one simple weather condition that accounts for the increasing trend of API in Hong Kong from 23 to 25 August 2004 as shown in Figure 2. (2 marks)
- (II) Even though the track of Aere was quite far away, the air quality of Hong Kong was affected quite significantly. Suggest another phenomenon associated with Aere which can account for the worst air quality recorded on 25 August 2004 and explain your answer briefly. (4 marks)

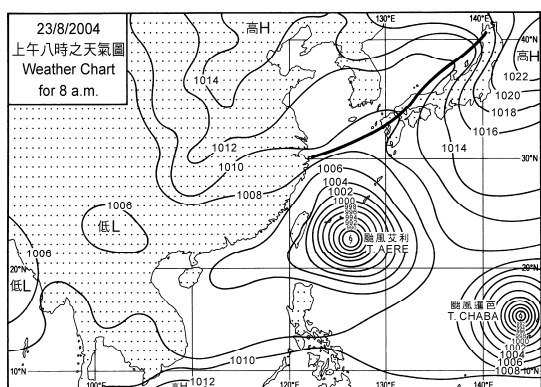


Figure 3 (a) Weather chart at 8:00 a.m. on 23/8/2004

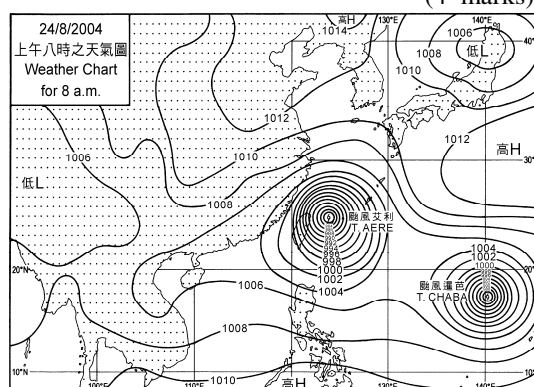


Figure 3 (b) Weather chart at 8:00 a.m. on 24/8/2004

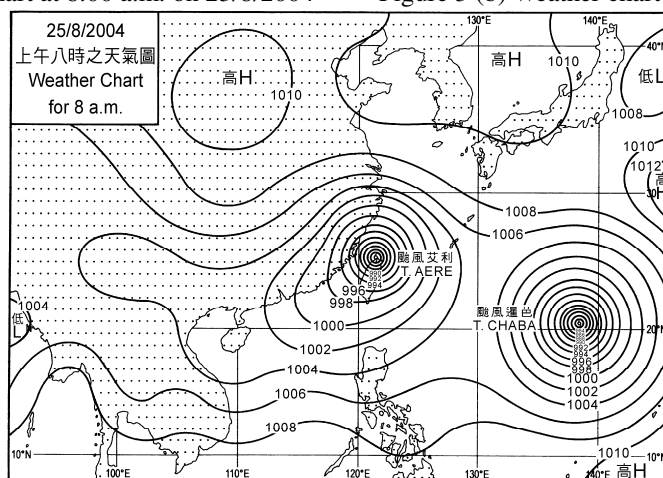
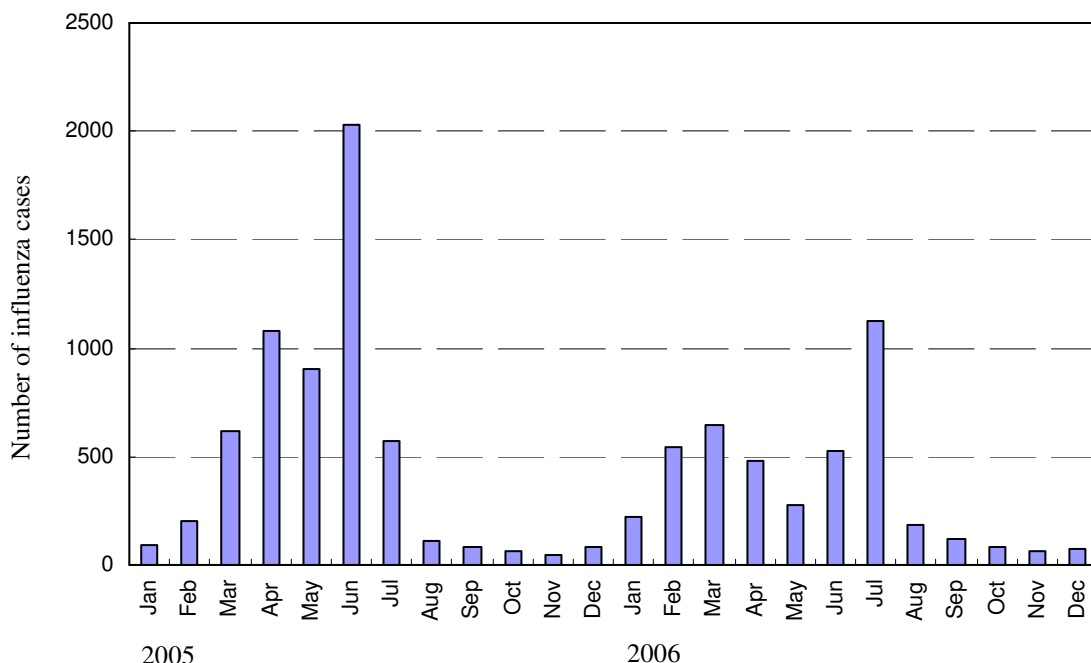


Figure 3 (c) Weather chart at 8:00 a.m. on 25/8/2004

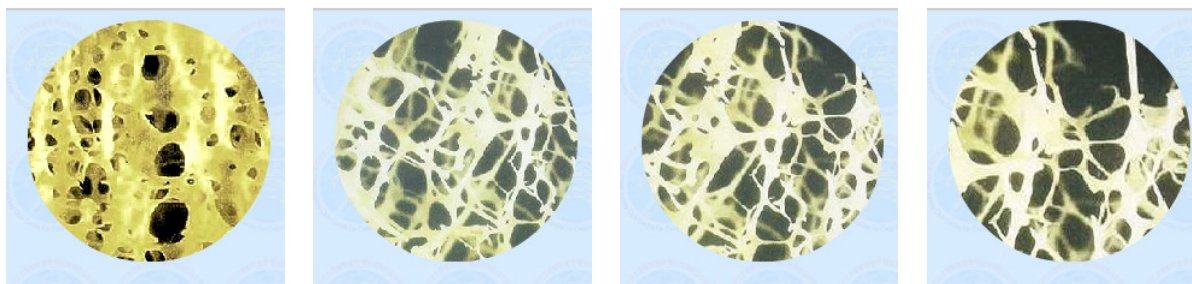
3. **Keeping Ourselves Healthy**

- (a) Influenza (flu) is a very common infectious disease. The typical symptoms of flu include fever, sore throat, and cough. When infected, people usually recover in two to seven days. However, in some population groups, serious complications may result. Thus, vaccination is recommended as a preventive measure to these groups of individuals in order to reduce the risk of contraction. Human flu shows a seasonal pattern in a city in South East Asia. The 2005 and 2006 patterns are shown in the graph below :



- (i) According to the graph, what pattern do you observe for the occurrence of flu in this city ? (1 mark)
- (ii) Suggest why people are recommended to receive flu vaccination in November or December. (2 marks)
- (iii) Why are the following two groups of individuals highly recommended to receive flu vaccination ? (2 marks)
- (I) elderly persons living in residential care homes (2 marks)
 - (II) health care workers such as nurses and doctors (2 marks)
- (iv) The flu vaccination only offers protection for one year. People will need to undertake a new flu vaccination annually. Suggest TWO reasons for such a short protection time of the flu vaccine. (2 marks)

3. (a) (v) (I) Explain why antibiotics cannot be used to treat flu. (2 marks)
- (II) What is the adverse effect of using antibiotics in treating flu? (1 mark)
- (b) The photographs below show human bone structures at different ages. They illustrate the progression of a degenerative disease that often goes undetected until a fracture occurs.



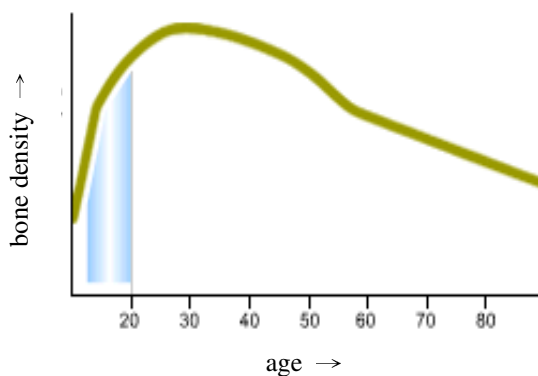
30 years old

50 years old

60 years old

70 years old

- (i) What is this disease? (1 mark)
- (ii) The graph below shows the variation of bone density with age.



- (I) Explain why it is important to build up our bone reserve at young ages. (3 marks)
- (II) Suggest and explain TWO ways to increase bone density at young ages. (4 marks)

END OF PAPER