INTEGRATED SCIENCE PAPER 1  
(Sample Paper)  
Question-Answer Book

Time allowed: 2 hours
This paper must be answered in English.

INSTRUCTIONS

(1) This paper consists of questions set on the Compulsory Part of the curriculum. The weighting of this paper is 45% of the Subject Mark.

(2) Answer ALL questions. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(3) Write your Candidate Number in the spaces indicated on the cover of this Question-Answer Book.

(4) Stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.

(5) Supplementary answer sheets will be provided on request. Write your candidate number, fill in the question number and stick a barcode label on each sheet. Tie them loosely but securely with a string INSIDE this Question-Answer Book.
Answer ALL questions. Write your answers in the spaces provided.

1. A simplified map of Country C is shown below. The river provides the major source of fresh water to this country.

(a) The Water Authority of the country noticed that the quality of fresh water supplied to City A and City B had worsened.

Which city would have high levels of cadmium and zinc, and which city would have a high level of the bacteria, *E. coli*, in the fresh water supplied to them? Explain your answer in each case.

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(4 marks)
1. (b) The government of this country is debating whether hydroelectric power (HEP) should be developed as an alternative energy source. A proposal has been made to build a dam at site D for the provision of HEP.

(i) Give TWO advantages of using HEP over the combustion of fossil fuel in generating electricity.

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(ii) Referring to the map, discuss ONE ecological concern and ONE social concern regarding the proposal to build the dam at site D.

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(6 marks)
2. It was a hot summer afternoon. The temperature was 35°C and the relative humidity was 75%. Peter just finished all his lessons. He passed by the basketball court and could not resist playing a game with his schoolmates before going home though the hot sun was shining on them. He finished the game at around 5:00 pm. Sweating heavily, he made his 10 minute-walk back home. When he arrived home, he put two cans of soft drinks into the –20°C freezer, turned on his bedroom air-conditioner, and headed for a cold shower. After the shower, he finished a whole can of the chilled soft drink and rested in the air-conditioned room.

(a) Explain why sweating can regulate Peter’s body temperature.

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(2 marks)

(b) Identify TWO measures that Peter employed to cool his body down. In each case, briefly explain whether the measure is effective.

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(4 marks)
2. (c) Peter’s mother returned home and found her son unwell. Peter told her that he might have got heatstroke when playing basketball under the hot sun. Explain whether Peter’s statement is correct or not.

(2 marks)

(d) When Peter woke up the next morning, he went to the fridge and fetched the other can of soft drink in the freezer. ‘Oh No!’ said Peter. What do you think had happened to the can of soft drink? Explain.

(2 marks)
3. The diagram below shows a 100 m sprinter in a crouch start position with front and rear feet resting on the starting blocks.

![Diagram of sprinter in crouch start position]

The graph below shows the horizontal components of the forces acting on the front starting block and rear starting block after the starting signal.

The graph below shows the horizontal components of the forces acting on the front starting block and rear starting block after the starting signal.

(a) It is common nowadays to state Newton’s Second Law of Motion in the form of \( F = ma \), where \( F \) is the force acting on an object of mass \( m \), and \( a \) is the acceleration. Newton stated, in his original work *Principia*, the Second Law in terms of change in momentum. Express the Second Law in this form.

\[ \text{expression} \]

(1 mark)

(b) The impulse exerted by the sprinter’s foot on the starting block is the change in momentum caused by the total force acting on the block during the time of contact.

Find, from the graph, the horizontal impulse exerted by the sprinter’s foot on the front starting block. (You are required to show how you arrive at your answer.)

\[ \text{calculation} \]

(3 marks)
3. (c) Suppose that the mass of the sprinter is 60 kg and the horizontal impulse exerted by the sprinter’s foot on the rear starting block is 77.5 Ns. Using your result in (b), calculate the horizontal velocity when the sprinter has just cleared off the starting blocks.

(2 marks)

(d) Make TWO suggestions to the sprinter which can help improve his performance.

(2 marks)

(e) Suggest the sources of energy for powering of the muscle at different times of the 100 m race.

(2 marks)
4. (a) In the early twentieth century, people believed that atoms were like a ‘plum pudding’ in which very tiny electrons were embedded in a diffused volume of positive charges. In 1910, Ernest Rutherford and his team carried out an experiment by firing a thin beam of $\alpha$-particles at high speed onto a gold foil. They expected most of the $\alpha$-particles to pass through the foil with little deflection. Out of their expectation, some of the $\alpha$-particles were found to have deflected by angles greater than 90° or even reflected.

(i) Sketch a labelled diagram to show the ‘plum pudding’ model of a lithium atom.

(ii) Based on the experimental results, Rutherford proposed another model of atom. The diagram below shows Rutherford’s model of an atom:

![Atomic Diagram](image)

Suggest why the above ‘unexpected’ experimental results can be explained using Rutherford’s model.

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(6 marks)
4. (b) Plotting the logarithm of the successive ionisation energies of an element against the order of removal of electrons can provide information about the electronic arrangement of atoms of the element. The table below lists the logarithmic values of the first eight ionisation energies of element X with atomic number less than 20.

<table>
<thead>
<tr>
<th>Order of removal of electrons</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \log_{10} ) (ionisation energy)</td>
<td>2.87</td>
<td>3.18</td>
<td>3.89</td>
<td>4.02</td>
<td>4.13</td>
<td>4.26</td>
<td>4.34</td>
<td>4.41</td>
</tr>
</tbody>
</table>

(i) Plot, on the graph below, the logarithm of these eight ionisation energies of X against the order of removal of the electrons.

(ii) Deduce what element(s) may X be. Explain your answer.

(6 marks)
5. (a) State Ohm’s law.

(b) A student set up the circuit as shown below to investigate the voltage-current relationship across a light bulb.

The results of the investigation are tabulated, and these data are plotted in the graph below.

<table>
<thead>
<tr>
<th>Voltage / V</th>
<th>0.0</th>
<th>1.0</th>
<th>2.0</th>
<th>3.0</th>
<th>4.0</th>
<th>5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current / A</td>
<td>0.0</td>
<td>0.18</td>
<td>0.24</td>
<td>0.30</td>
<td>0.34</td>
<td>0.39</td>
</tr>
</tbody>
</table>

(i) State whether the above results are in agreement with Ohm’s law. Justify your answer.
5. (b) (ii) What advice would you give the student in taking measurements so that he would not miss out important information of the current-voltage characteristics of the light bulb? Explain your answer.

(iii) Find the resistance of the light bulb at 2 V and at 5 V. Propose an explanation for any difference in the results obtained.

(c) In a model to account for metal conductivity, a metal is considered to be consisting of positive ions arranged in fixed arrays and the electrons move freely inside the metal.

(i) Draw a diagram to illustrate this model.

(ii) On the basis of this model, account for the resistance of metals to current flow.

(7 marks)
6. Read the passage below and answer the questions that follow:

**Ciguatoxin**

Ciguatoxin is a fat-soluble toxic chemical produced by some algae found in the tropical and subtropical coral reef. When fish feed on the algae, they will get the toxin. The toxin is difficult to be broken down or excreted by the fish. If a human consumes the contaminated fish, ciguatera fish poisoning may result. The risk is greater if the contaminated fish consumed is of mass greater than 2 kg. The toxin can affect our nervous, digestive and/or cardiovascular systems.

(a) Explain why eating bigger fish is more likely to cause ciguatoxin poisoning than eating smaller fish.

(3 marks)

(b) Suppose that the water where the ciguatoxin-producing algae live is moderately polluted with organic matters. Describe and explain the effect of such pollution on ciguatera fish poisoning.

(3 marks)
For question 7, candidates are required to present their answers in essay form. 6 marks will be allocated to science knowledge, and 2 marks to logical presentation and clarity of expression.

7. With reference to the nature of ultraviolet radiation, discuss the health hazards associated with overexposure to the radiation and how its applications have improved our living.

(8 marks)
8. Trace amounts of $^{238}\text{U}$ are present in rocks. $^{238}\text{U}$ undergoes a series of α and β decays to give $^{222}\text{Rn}$. $^{222}\text{Rn}$ is a radioisotope of radon, which is a noble gas.

(a) Find the number of α particles and that of β particles emitted from $^{238}\text{U}$ to give $^{222}\text{Rn}$.

(2 marks)

(b) Account for the difference in the penetrating power of α particles and β particles.

(3 marks)
8. (c) $^{222}_{86}$Rn is an indoor pollutant and is considered as an ‘invisible killer’. It undergoes $\alpha$ decay with a half-life of 3.8 days to give $^{218}_{84}$Po.

(i) Suggest TWO reasons why $^{222}_{86}$Rn is so dangerous.

(ii) Suggest ONE way to prevent the accumulation of indoor $^{222}_{86}$Rn.

(3 marks)
9. The flow-diagram below outlines the procedure of the production of human insulin using recombinant DNA technology:

(a) What is the role of the plasmid vector?

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(1 mark)
9. (b) What is Process A in the flow-diagram?

(1 mark)

(c) Insulin extracted from pig pancreas was once widely used in treating diabetes.

Give TWO advantages of using human insulin prepared from recombinant DNA technology outlined above over using insulin extracted from pigs.

(2 marks)

(d) Some athletes inject insulin as an anabolic drug to enhance sport performance. If these athletes do not suffer from diabetes, explain the health risk that they will have in taking insulin.

(3 marks)
10. A part of a DNA sequence coding for a protein and a codon usage table are shown below:

\[
\text{Start codon} \\
\begin{array}{l}
\text{ATG} \\
\end{array}
\]

5′- GCC GCG CTG TGG ATG -3′ (coding strand) 
3′- CGG TAC CGG GAC ACC TAC -5′ (template strand)

<table>
<thead>
<tr>
<th>1st base</th>
<th>2nd base</th>
<th>3rd base</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>Phe</td>
<td>UAU</td>
</tr>
<tr>
<td>U</td>
<td>Leu</td>
<td>UAA</td>
</tr>
<tr>
<td>U</td>
<td>UUC</td>
<td>CAU</td>
</tr>
<tr>
<td>C</td>
<td>Leu</td>
<td>CAA</td>
</tr>
<tr>
<td>A</td>
<td>Iso</td>
<td>AAA</td>
</tr>
<tr>
<td>G</td>
<td>Val</td>
<td>Ala</td>
</tr>
</tbody>
</table>

(U, C, A and G stand for the 4 different bases in the nucleotide. The various amino acids are represented by their short forms.)

(a) Given that the direction of transcription is from 5′ to 3′, write the mRNA sequence after transcription.

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(2 marks)
10. (b) With reference to the codon usage table, provide the amino acid sequence after translation.

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(2 marks)

(c) For each of the following cases, suggest how the amino acid sequence in (b) will change, if any, and explain whether it will affect the resulting protein to be translated.

(i) The ‘CG’ pair in position (I) is changed to ‘AT’ pair.

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(ii) The ‘GC’ pair in position (II) is changed to ‘AT’ pair.

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(4 marks)

END OF PAPER
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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 blood glucose level in normal human body with time.

![Graph showing variations of hormone levels](image)

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. 

Draft as of November 2008
10. A runner wears a pair of air-cushioned sports shoes. Which of the following descriptions about the function of the air-cushion and its effect on the runner is correct?

A. It increases the impact time of the shoe's 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:

<table>
<thead>
<tr>
<th></th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of protons</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>No. of electrons</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>No. of neutrons</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

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 it becomes molten.

![Diagram of experiment setup]

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:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Attraction between particles in substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) helium</td>
<td>van der Waals forces</td>
</tr>
<tr>
<td>(2) diamond</td>
<td>covalent bond</td>
</tr>
<tr>
<td>(3) magnesium oxide</td>
<td>ionic bond</td>
</tr>
</tbody>
</table>

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 trophic levels in the ecosystem.

![Diagram of energy flow](image)

Key: ➔ 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.

![Diagram of timber harvesting methods](image)


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)?

- Process (1)
  - A. decomposition nitrogen fixation
  - B. decomposition nitrification
  - C. nitrogen fixation nitrification
  - D. nitrification nitrogen fixation

- Process (2)
  - 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.

![Chromosome Diagram]


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?

![DNA fingerprint diagram]

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.

\[
\begin{align*}
\text{DDT} & \quad \begin{array}{c}
\text{C}\text{Cl}_3 \\
\text{C}\text{l} \\
\text{C}\text{l}
\end{array}
\end{align*}
\]

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

\[ \cdots \text{CH}_2\text{C}==\text{CH}\text{CH}_2\text{CH}_2\text{C}==\text{CH}\text{CH}_2\text{CH}_2\text{C}==\text{CH}\text{CH}_2\cdots \]

\[ \text{CH}_3 \quad \text{CH}_3 \quad \text{CH}_3 \]

(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) 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:

![Ozone Concentration Graph](image)

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.

![Weather Charts](image)

*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
(Courtesy of the Hong Kong Observatory)*

![Roadside API Graph](image)

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

(Source: http://www.epd-asg.gov.hk/download/hourly/eng/hr082004.csv)
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 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)
Keeping Ourselves Healthy

(a) Influenza (flu) is a very common infectious disease. The typical symptoms of flu include fever 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?

(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

(Source: http://www.jococ.org/)

(i) What is this disease? (1 mark)

(ii) The graph below shows the variation of bone density with age.

(Source: http://www.jococ.org/)

(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