

香港考試及評核局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
香港中學文憑考試
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

練習卷
PRACTICE PAPER
綜合科學 試卷一
INTEGRATED SCIENCE PAPER 1

評卷參考
MARKING SCHEME

(2012年2月24日修訂稿)
(updated as at 24 Feb 2012)

本評卷參考乃香港考試及評核局專為本科練習卷而編寫，供教師和學生參考之用。學生不應將評卷參考視為標準答案，硬背死記，活剝生吞。這種學習態度，既無助學生改善學習，學懂應對及解難，亦有違考試着重理解能力與運用技巧之旨。

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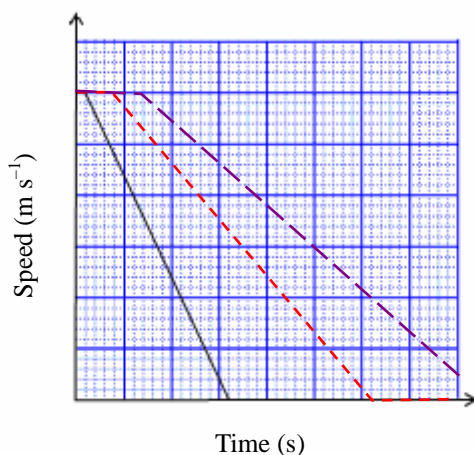
Paper 1

1. (a) (i) Hydrogen bonding 1
- (ii) In ice, the water molecules are set apart and neatly arranged by hydrogen bonds to form an open structure. 1
(No mark for 'hexagonal structure' only)
Thus, the water molecules in ice are less closely packed than those in water. 1
- (iii) Ice floats on water forming an insulating layer on the top of a lake. 1
Organisms can continue to live in water beneath the layer of ice when the lake has not entirely frozen. 1
- (b) (i) Water collected in reservoirs / from rain water 1
The amount of rainfall / water held in reservoirs became insufficient to meet the increasing demand for fresh water due to the rapid growth of population / industries. 1
- (ii) (1) $E = mc\Delta T + ml$
 $= 1000 \times 4200 \times 80 + 1000 \times 2.26 \times 10^6$ 1
 $= 2.60 \times 10^9 \text{ J}$ 1
(1 mark for the method; 1 mark for the correct answer.)
- (2) The cost of desalination is very high
because a large input of energy is required / a large amount of fuel is needed to provide the energy required to bring water to boil for distillation,
due to the high latent heat of vaporisation and high specific heat capacity of water. 1
- (iii) (1) The discharge of domestic / industrial / agricultural waste water into the Dongjiang 1
- (2) Any ONE of the following: 1
– Delivering Dongjiang water directly to Hong Kong in closed pipes / aqueducts to protect the water from possible pollution sources. (1)
– Treating all sewage before discharging it into the Dongjiang catchment. (1)
– Increasing the penalty for illegal sewage discharge into the Dongjiang catchment. (1)
(Accept other correct alternatives.)

Total: 13 marks

2. (a) Speed limit = $70 \text{ km h}^{-1} = 70 \times 1000 \div 3600 = 19.4 \text{ m s}^{-1}$
 Initial speed of the car = 15 m s^{-1} , which is smaller than the speed limit (19.4 m s^{-1}).
 Therefore, the driver was not speeding.
 (Alternative method: initial speed of car = $15 \text{ m s}^{-1} = 15 \times 3600 \div 1000 = 54 \text{ km h}^{-1}$
 $54 \text{ km h}^{-1} < 70 \text{ km h}^{-1}$, therefore the driver was not speeding.)
- (b) Light receptors in the eyes were stimulated and set up nerve impulses. 1
 The impulses were transmitted to the brain along the (sensory) neurone / (optic) nerve. 1
 The brain interpreted the nerve impulses so that the driver could see the box. 1
 The brain made a decision and send out nerve impulses (via the motor neurons) to relevant muscles for coordinated contraction to apply the brakes. 1
- (c) Distance travelled by the car before it stopped = area under the speed–time graph 1
 $= (0.2 + 3.2) \times 15 \div 2$
 $= 25.5 \text{ m}$ 1
 The distance travelled by the car is 25.5 m, which is smaller than 30 m. 1
 Therefore the car did not hit the box.
 (1 mark for the method; 1 mark for the correct answer; 1 mark for comparing the distances for making the judgement.)
- (d) (i) The brain 1

(ii)



- Both dotted lines shown are acceptable answers. The speed–time graph should show:
- a longer reaction time 1
 - a smaller slope for the deceleration part 1

Total: 11 marks

3. (a) (i) $2[\text{Al}]^{3+} 3[\text{O}]^{2-}$
- By transferring electrons from aluminium to oxygen,
both aluminium and oxygen can attain a stable noble gas electron arrangement. 1
1
- (ii) (1) Accept any value which is > 65.2 and < 70 1
- (2) $\text{Ga}^{3+}(\text{l}) + 3\text{e}^{-} \rightarrow \text{Ga}(\text{l})$ 1
- (3) Zinc has more than one isotope 1
and their relative abundance is not the same. 1
- (b) (i) The linear shape of the molecule makes the dipoles resulting from the 2 C=O bonds
cancel each other. 1
- (ii) van der Waal's forces 1
- (iii) In his proposal, SiO_2 has a simple molecular structure 1
in which molecules are held by weak van der Waal's forces. 1
Thus, it should have a melting point much lower than 1610°C .

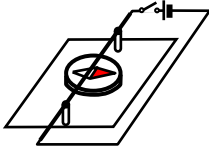
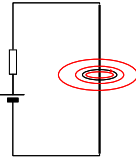
Total: 11 marks

4. (a) Increased breathing rate allowed Rosy to take in more oxygen and give out more carbon
dioxide. 1
Her heart beat increased to speed up the transport of oxygen and nutrients to the cells 1
so that more energy could be released through cellular respiration for the vigorous activity. 1
- (b) (i) hypothalamus * 1
sweat gland* 1
- (ii) Effector 2 dilated (i.e. vasodilation). 1
More blood flowed to the skin surface of Rosy's face, turning her face red. 1
This allowed more effective heat dissipation to cool her down. 1
- (c) It replenished the water lost through sweating. / This helped to cool her body down. 1

Total: 9 marks

5. (a) (i) Identical twins occur when a fertilized egg splits and develops into two embryos. 1
- (ii) Although identical twins share the same genetic make-up (genotype), the expression of the genes controlling the fingerprint pattern (phenotype) can be affected by environmental factors. 1
- (b) (i) Husband: Tt , Wife: Tt (1 mark for both answers are correct.) 1
- (ii) Punette square: 1
- | | | |
|-----|------|------|
| | T | t |
| T | TT | Tt |
| t | Tt | tt |
- View: 1
- Yes, because there is only $\frac{1}{4}$ chance of having an affected child (tt). (1)
- OR
- No, it is too risky as there is $\frac{1}{4}$ chance of having an affected child (tt). (1)
- (1 mark for the correctly drawn Punette square; 1 mark for supporting the view with the predicted chance.)

Total: 6 marks

6. (a) (i) Choice of set-up:  1
- Predicted result: The compass needle will turn and come to a position that is parallel to the current-carrying wire. 1
- (ii) (1) The arrowhead drawn on the magnetic field line should indicate a clockwise direction. 1
- (2)  (The drawing should show that the magnetic field lines near the wire are denser while the magnetic field lines further away from the wire are sparsely packed.) 1
- (b) (i) 500, 1000, 1500, 2000 (1 mark for all answers being correct.) 1
- (ii) correct axes with labels, in appropriate scale 1
- correctly plotted points (any 3 correctly plotted points; ± 1 box) 1
- best fit line drawn 1
- (iii) The magnitude of the magnetic field is directly proportional to the number of turns per unit length of the solenoid (i.e. $B \propto n$). 1
- (iv) Any ONE of the following: 1+1
- The relative positions between the solenoid and the sensor must be fixed because the magnitude of the magnetic field outside the solenoid is different at different positions. (1+ 1)
 - The experiment should be conducted far away from magnets / other electromagnetic devices (e.g. electromagnet) so that the magnetic field due to the solenoid is not affected. (1+ 1)
 - Put the sensor inside the solenoid because the magnetic field is uniform inside the solenoid. (1+ 1)
- (1 mark for the precaution; 1 mark for the explanation.)

Total: 11 marks

7. (a) Any ONE of the following:
- Proper irrigation / The use of fertilizers provides the necessary raw materials (water / minerals) for better crop growth. (1)
 - Growing crops in a greenhouse provides a suitable temperature for better crop growth. (1)
 - The use of insecticides / Growing crops in a greenhouse protects the crops from damage by pests. (1)
 - By selective breeding, farmers can obtain crops that are better adapted to growth in a particular environment. (1)
- (b) When an insecticide is first applied, most insects are killed while those with resistance to the insecticide survive. 1
 These resistant insects grow, mature and reproduce to pass this resistance to their offspring. 1
 After repeated rounds of selection by the same insecticide, the proportion / percentage of resistant individuals in the population increases, rendering the insecticide less effective. 1
- (c) Nutrients in soil, which are taken up by crops for growth, are removed after the crops are harvested. 1
 The remains of crops and dried animal manure are decomposed by decomposers / bacteria / fungi / microbes to inorganic nutrients. 1
 These inorganic nutrients are then available to the crops in next planting / maintain the fertility of the soil to maintain the crop yield. 1
- (d) Genes from different species are made up of the same 4 types of nucleotides. 1
 Since codon usage is universal / the same codon codes apply for the same amino acids in different species, 1
 the transferred gene can be correctly decoded (i.e. transcribed) to make the same gene product (i.e. translated into protein) in the new host. 1

Total: 10 marks

8. (a) ${}_{43}^{99}\text{Tc}^* \rightarrow {}_{43}^{99}\text{Tc} + \gamma$ 1
- (b) (i) Decay is a random process. Activity, which is the number of decays per second, therefore exhibits randomness. 1
- (ii) Half-life of Technetium-99m = 6 hours 1
 (Accept an answer within the range 5.5 – 6.5 hours, as estimated from the graph.)
- (iii) No. of half-lives = 24 hours \div 6 hours = 4 [accept 3.69 -4.36 half-lives] 1
 Activity of the Technetium-99m in the patient 24 hours later
 = 370 MBq $\times (\frac{1}{2})^4$
 = 23.1 MBq [accept 17.9 -28.6 MBq] 1
 (1 mark for the method; 1 mark for the correct answer.)
- (c) X is not suitable because it has a long half-life. It will accumulate in the body for a long time, rendering it hazardous to health. 1
 Y is not suitable because the α radiation emitted has a strong ionization power, which causes damage to body cells. 1

8. (d) In the approach taken by radiologist P, the annual dose
 = $0.0015 \text{ Sv} \times 12$
 = 0.018 Sv 1
 In the approach taken by radiologist Q, the annual dose
 = $0.0015 \text{ Sv} \times 2$
 = 0.003 Sv 1
 For either approach, the annual dose is within the 'no health effects observed' zone. 1
 Comment on either one of the approaches: 1
 – Radiologist Q adopts the ALARA (As Low As Reasonably Achievable) principle, i.e. the use of radioisotopes is kept to a minimum as long as diagnosis can be made. (1)
 – Without causing any health effects on the patient, radiologist P's approach allows a close monitoring of the patient's condition. (1)

Total: 11 marks

9. Knowledge (6 marks)
- Socioeconomic impact: max.3
 – Building cities can bring about improvements in living standards. (1)
 – Building cities can provide more employment opportunities. (1)
 – Growing crops can provide more food. (1)
 – Growing cash crops can bring in income. (1)
 – Timber obtained from the cleared forests can bring in income. (1)
- Ecological impact: max.3
 – A reduced number of producers may upset the stability of the food web. (1)
 – With fewer trees to absorb carbon dioxide, there may be a net increase in the concentration of the atmospheric carbon dioxide. This may speed up global warming. (1)
 – The clearing of forests leads to a loss of habitats for many organisms, and hence may cause a reduction in biodiversity. (1)
 – The water retentivity of the soil in the area is reduced, which may lead to soil erosion or flooding. (1)

Organisation and presentation (2 marks)

Mark by impression. The guidelines for awarding marks for organisation and presentation are as follows:

2	Answers are well structured, showing coherence of thought and organisation of ideas with no or little irrelevant materials. Shows a good command of language.
1	Answers are organised but lack clarity and fluency. The language used is comprehensible.
0	Answers are chaotic, showing no attempt at organising thought, and contain a lot of superfluous materials. The language used is incomprehensible.

Total: 8 marks

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PRACTICE PAPER

綜合科學 試卷二
INTEGRATED SCIENCE PAPER 2

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Section A

Question No.	Key	Question No.	Key
1	B	21	B
2	D	22	C
3	D	23	C
4	C	24	A
5	C	25	D
6	B	26	A
7	D	27	B
8	C	28	B
9	C	29	D
10	D	30	B
11	D	31	B
12	C	32	A
13	A		
14	A		
15	D		
16	A		
17	C		
18	A		
19	A		
20	B		

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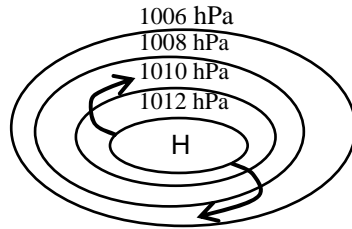
Paper 2 Section B

1. Energy, Weather and Air Quality

- (a) (i) When the surface temperature of a region is low, the temperature of an air parcel within the region is low. 1
 This air parcel contracts and becomes denser than the surrounding air, and therefore sinks downwards. 1
 Surrounding air fills the space above the air parcel and the atmospheric pressure in the region becomes high. 1

- (ii) The Coriolis effect is due to the rotation of the Earth. 1

- (iii) 1



Total: 5 marks

- (b) (i) (1) More solar radiation that passes through the atmosphere is reflected and scattered by the icy surface of Siberia back to the atmosphere. 1
 Hence, less solar radiation is absorbed by the Earth's surface and less long-wavelength infra-red radiation is re-emitted by the Earth's surface. 1
 The consequence is that less infra-red radiation is absorbed by greenhouse gases in the atmosphere to heat the Earth's surface. 1
 Therefore, Siberia remains at a low temperature during winter.

- (2) As cold air holds less water vapour than warm air, the air in Siberia in winter is drier. 1

- (ii) Since land has a smaller specific heat capacity than water, the land mass in Siberia cools off more quickly than its neighbouring waters (e.g. the Pacific Ocean). 1
 The high pressure built up over the land mass causes the outbursts of cold air from it. The outbursts become the northeasterly winter monsoon that persists during the winter in Hong Kong. 1

Total: 7 marks

- (c) (i) It may cause allergy or induce asthma. / It reduces the lung function in the long run. 1

- (ii) (1) As shown in Figure 1.3, there was a high pressure over Taiwan. 1
 Therefore, there was an east wind prevailing in Hong Kong. 1
 The wind brought the particulates in the sandstorm from Taiwan to Hong Kong. 1
 This caused the rise in RSP concentration on 21 March.

- (2) When the RSP concentration is high, more light is scattered by the suspended particles or fine dust in the air. 1
 Less light from the object reaches our eyes, resulting in poor visibility. 1

- (3) RSP would be washed away by rainfall. 1
 The air quality would be improved due to the reduction of RSP in the air. 1

Total: 8 marks

2. Keeping Ourselves Healthy

- (a) (i) (1) To ensure that the volunteers were free from the dengue virus before the experiment. / It is difficult to ensure that volunteers in a dengue affected area are free from dengue virus before the experiment. 1
- (2) The white blood cells (phagocytes) will try to eliminate the viruses by engulfing them (phagocytosis). 1
- (3) During the first infection, memory cells register the antigens on the particular subtype of dengue virus. 1
Upon second infection of the same subtype of dengue virus, the memory cells recognise the virus and trigger the immune system to produce a large number of antibodies / killer T cells within a short period of time. 1
The invading viruses are eliminated before they can reproduce to a large enough number inside the body to cause any illness. 1
- (ii) (1) The incidence of dengue fever rises with increasing global temperatures. 1
- (2) A higher air temperature favours the growth of the vector mosquito population. 1
With global warming, more areas are expected to become warmer and become suitable for mosquitoes to survive. / With global warming, mosquitoes will be found in places where they could not be found before. 1
Dengue fever will cover a wider area in the world. / More people will be at risk of dengue fever. 1
- (iii) – Empty containers / pails / buckets / dishes for plant pots 1
OR
Cover containers / tanks / bucket to avoid accumulation of water
– so as to remove the sites necessary for mosquitoes to lay eggs. 1
- Total: 12 marks
- (b) (i) Male 1
The crude incidence rate of liver cancer is consistently higher in males than in females. 1
- (1) Relative risk (infection by HBV) = 4.82 1
Relative risk (frequent consumption of fruit) = 0.869 1
- (2) Infection by HBV is a risk factor whereas frequent consumption of fruit is not a risk factor. 1
- (3) – The high relative risk is statistically significant and indicates a strong association between smoking and liver cancer. 1
OR
Smoking can be regarded as a risk factor for liver cancer as there is a higher incidence of liver cancer among smokers than among non-smokers. 1
– It, however, does not provide the information needed to meet the criteria for establishing causation (e.g. stronger correlation between heavy smokers and liver cancer; laboratory tests showing that smoking is a plausible cause of liver cancer). 1
- (iii) The immune system has to be suppressed to avoid rejection of the transplanted liver / to avoid the transplanted liver from being attacked by white blood cells or killer T cells. 1
Keeping the patient in an isolation ward can protect him/her from possible infections / prevent complications due to infection when his/her body defences are weak. 1

3. Chemistry for World Needs

- (a) (i) Addition polymerisation 1
 Structure of polyacrylamide: 1
- $$\left[\text{CH}_2 - \underset{\begin{array}{c} | \\ \text{C}=\text{O} \\ | \\ \text{NH}_2 \end{array}}{\text{CH}} \right]_n$$
- (ii) The lone pair of electrons in the oxygen atom of each repeating unit in the polymer are capable of forming a hydrogen bond with a water molecule. 1
- (iii) (1) The material should not be an allergen to the skin. / It is non-toxic. 1
- (2) Cellulose is biodegradable. 1
 The production of polyacrylamide involves the use of petroleum, which is a non-renewable resource. 1
- (3) Any TWO of the following: 2
- Polyacrylamide improves water retentivity of soil so that less water is needed for irrigation. (1)
 - Polyacrylamide improves water retentivity of soil so that plants can be grown in places with scarce water supply. (1)
 - Soil particles are bound by water retained in the polyacrylamide which helps prevent soil erosion. (1)

Total: 9 marks

- (b) (i) (1) reversible reaction 1
 In a reversible reaction, some products are converted back to the reactants. 1
- (2) A high pressure helps increase the yield. 1
 As the gaseous volume in the product side is smaller than that in the reactant side, an increased pressure favours the forward reaction / shifts the equilibrium to the product side. 1
- (ii) (1) The two nitrogen atoms are bound by three covalent bonds in a molecule of nitrogen. High activation energy is required to break the bonds. 1
- (2) Any ONE set of the following: 2
- Atmospheric nitrogen is fixed into ammonium compounds by the nitrogen fixing bacteria. (1)
 - Atmospheric nitrogen is converted to nitric acid through lightning. (1)
- (3) Nitrogen fertilisers provide nutrients to algae in the water body and cause their excessive growth (algal bloom). 1
 The excessive algal growth depletes the dissolved oxygen, which causes the death of other aquatic life. 1

Total: 11 marks