Phase 2

Screening Test
Read carefully the following instructions:

1. The time available is 2 hours.

2. Check that you have a complete set of the test questions and the answer sheet.

3. Write your name and school name on the examination paper and answer sheet.

4. There are 45 multiple-choice questions and 7 short questions in total.

5. All multiple-choice questions will be in 4-option format.

6. Point rules:
   Full mark: 75 points
   Multiple Choice (45 points)
   - Correct answer: +1.0 points
   - Wrong answer: -0.5 points
   - No answer: 0.0 point
   Short Questions (30 points)

7. You should mark the answers on the answer sheet using. Answers written in the question book will not be marked.

8. This examination paper must be returned together with your answer sheet.
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PART A: Multiple Choice (Correct: +1.0 points; Wrong: -0.5 points; No answer: 0.0 points)

1. Which of the following polymers is/are typically produced by condensation polymerization?
   (i) Polystyrene (PS)
   (ii) Rubber
   (iii) Polyethylene terephthalate (PET)
   (iv) Polytetrafluoroethylene (PTFE)

   A. (iii) only
   B. (ii) and (iii) only
   C. (ii), (iii) and (iv) only
   D. (i), (ii) and (iii) only

2. Which of the following substances contain(s) carbon-carbon double bonds?
   (i) Sunscreen
   (ii) Petroleum jelly
   (iii) Polyethylene (PE)
   (iv) Cooking (corn) oil

   A. (i) only
   B. (i) and (iii) only
   C. (ii) and (iv) only
   D. (i) and (iv) only

3. Which of the following compounds can be oxidized to give a ketone?
   A. primary alcohol
   B. secondary alcohol
   C. tertiary alcohol
   D. aldehyde
4. Given that the bond lengths of the C=O and C-O bonds in ethanoic acid are 1.24Å and 1.43Å, respectively. (1 Å = 1 x 10^{-10}m) What are the lengths of the bonds (i) and (ii) in the ethanoate ion?

![Diagram of ethanoate ion]

A. (i) = 1.24 Å, (ii) = 1.43 Å  
B. (i) = 1.24 Å, (ii) = 1.50 Å  
C. (i) = 1.20 Å, (ii) = 1.40 Å  
D. (i) = 1.27 Å, (ii) = 1.27 Å

5. How many stereoisomers does the following compound have?

![Diagram of compound]

A. 2  
B. 4  
C. 8  
D. 16

6. Calculate the volume of gaseous product produced (measured at 25°C and 1 atm) from the fermentation of 15 g of glucose (C₆H₁₂O₆)? (atomic masses: C = 12.0, H = 1.0, O = 16.0)

A. 1.0 dm³  
B. 2.0 dm³  
C. 4.0 dm³  
D. 8.0 dm³
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7. Which of the following types of polymers has the strongest intermolecular force?

A. Nylon  
B. Polystyrene (PS)  
C. Polyvinyl chloride (PVC)  
D. Polytetrafluoroethylene (PTFE)

8. Which of the following refrigerants has the least adverse effects to the Earth’s ozone layer?

A. CFC-10  
B. CFC-13  
C. HFC-32  
D. HCFC-22

9. In testing the dehumidifying capacity for household portable dehumidifiers, which of the following sentence is true?

A. A dehumidifier that claims to have 25 liters capacity must dehumidify better than the other one with 20 liters capacity.  
B. A dehumidifier will have a higher capacity when tested at condition of high relative humidity.  
C. There exist no mandatory standard test conditions for rating dehumidifying capacity of household portable dehumidifiers at present in Hong Kong.  
D. The test conditions are exactly the same for all the standards used in the world.

10. Which of the followings is incorrect?

A. “SnAgCu” solder is more expensive than “tin-lead” solder.  
B. The melting point of “SnAgCu” solder can be changed by changing its composition.  
C. The reason of using silver as one of the components in “SnAgCu” solder is to increase the electrical conductance of the solder.  
D. One of the advantages of “SnAgCu” solder over “tin-lead” solder is that the “SnAgCu” solder is less environmentally polluting.
11. The water cycle in the Nature can be summarized in the four processes (A to D) below. In which of them is hydro-power generated?

A. Evaporation of sea water  
B. Formation of cloud from water vapor and dust  
C. Raining  
D. Water in reservoirs running into rivers and seas

12. Which of the followings is involved in “cracking” process?

A. Fission of uranium nuclei  
B. Melting methane ice to release methane gas  
C. Changing long-chain hydrocarbons to short-chain hydrocarbons  
D. Separating components of crude oil according to their boiling points

13. Mineral is a source for many elements. Which of the following elements is most likely to exist as in the form of element, rather than compound, in mineral?

A. Oxygen  
B. Sodium  
C. Fluorine  
D. Silver

14. What is the main component of natural gas?

A. Hydrogen  
B. Carbon monoxide  
C. Methane  
D. Butane

15. Which of the following types of electromagnetic radiations is one of the radioactive decay products?

A. Radio wave  
B. Microwave  
C. Infra-red  
D. Gamma-ray
16. A stone is projected vertically upwards by a man so that it reaches its highest point and return to the ground. Which of the following statements is/are correct?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>The kinetic energy of the stone as it is projected is equal to that as it falls back to the original position.</td>
</tr>
<tr>
<td>II.</td>
<td>The total mechanical energy (K.E. + P.E.) of the stone is the minimum when it reaches the highest point.</td>
</tr>
<tr>
<td>III.</td>
<td>The work done on the stone by the man is equal to the gain of potential energy of the stone at the highest position.</td>
</tr>
</tbody>
</table>

A. I only  
B. II only  
C. I and III only  
D. II and III only

17. A block of mass 2 kg is pulled up an inclined plane with constant velocity as shown in the figure. The inclination of the plane is 60° and the distance moved along the plane is 20 m. Find the work done on the block by the pulling force.

A. 173 J  
B. 200 J  
C. 250 J  
D. 346 J
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18. Two objects of masses $M$ and $m$ are connected by a light and inextensible string passing over a smooth pulley as shown in the figure. After $M$ is released, $m$ goes down a distance $h$. Which of the following statements is/are correct?

(i) The potential energy lost by $m$ is $mgh$.
(ii) The potential energy gained by $M$ is $Mgh$.
(iii) The potential energy lost by $m$ equals the potential energy gained by $M$.
(iv) Energy is not conserved as some of them is dissipated to heat.

A. (i) only
B. (i) and (iv) only
C. (i) and (iii) only
D. (iii) and (iv) only

19. It seems easier to bring a heavy load up a step by pulling it along an inclined plane. Which of the following is/are the advantage(s) of using this method over carrying the load directly up the step by a vertical effort?

(1) A smaller effort is required.
(2) Less energy is required.
(3) The distance travelled by the effort is smaller.

A. (1) only.
B. (2) only.
C. (1) and (3) only.
D. (2) and (3) only.
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20. Which of the following about nuclear energy is/are correct?

(i) When a neutron is bombarded on a uranium nucleus, only one neutron can emit in controlled nuclear fissions.
(ii) Nuclear fission is an example of chain reactions.
(iii) Both fossil fuels and nuclear power are examples of non-renewable sources of energy.

A. (i) only  
B. (iii) only  
C. (i) and (iii) only  
D. (ii) and (iii) only

21. Referring to the resistor network in the figure, all the resistors are identical and of resistance 2 Ω each.

Find the equivalent resistance across points P and Q

A. 4.0 Ω  
B. 2.0 Ω  
C. 1.5 Ω  
D. 1.25 Ω
22. In the circuit shown, all bulbs are identical. Which bulb is the brightest when the circuit is closed?

A. P  
B. Q  
C. R  
D. T

Questions 23 to 25 refer to the following information:

<table>
<thead>
<tr>
<th>First statement</th>
<th>Second statement</th>
<th>2nd statement is a correct explanation of 1st statement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. True</td>
<td>True</td>
<td>2nd statement is a correct explanation of 1st statement.</td>
</tr>
<tr>
<td>B. True</td>
<td>True</td>
<td>2nd statement is NOT a correct explanation of 1st statement.</td>
</tr>
<tr>
<td>C. True</td>
<td>False</td>
<td></td>
</tr>
<tr>
<td>D. False</td>
<td>True</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First statement</th>
<th>Second statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>23. A voltmeter affects the circuit current very small when it is used to measure voltage in a proper way.</td>
<td>Voltmeter has a very small resistance.</td>
</tr>
<tr>
<td>24. Thick wires are used in heavy electrical appliances, for examples, heaters and air-conditioners.</td>
<td>A thin wire produces more heat than a thick wire does when the same current passes through them.</td>
</tr>
<tr>
<td>25. When two bulbs are connected in parallel to the same voltage, the one with higher wattage will be brighter.</td>
<td>The currents through the bulbs are the same.</td>
</tr>
</tbody>
</table>
26. What colour will be transmitted through overlapping cyan and yellow filters?

   A. Red
   B. Green
   C. Blue
   D. White

27. If you zapped an enemy spacecraft above the atmosphere and just above the horizon with a laser, would you aim the laser

   A. above the visible aircraft
   B. below the visible aircraft
   C. directly at the visible aircraft
   D. none of the above

28. You are given two convex lenses with different focal lengths. Which lens should have the larger magnification?

   A. the lens with the larger focal length
   B. the lens with the smaller focal length
   C. both lenses should have the same magnification
   D. none of the above

29. An image is located at exactly the same position as its object, for a concave mirror of focal length 5cm. What is the object distance from the mirror?

   A. 10 cm
   B. 5 cm
   C. 15 cm
   D. 2.5 cm
30. A lamp is placed 5m below the surface of a pool of unknown liquid and circle of light is observed coming out of the surface with a radius of 4m. What is the refractive index of the unknown liquid?

A. 1  
B. 1.33  
C. 1.52  
D. 1.60

31. Humans affect the environment in the following ways:

(i) deforestation  
(ii) harvesting of marine algae  
(iii) re-afforestation  
(iv) combustion of fossil fuels  
(v) over-use of chemical fertilizers

Which activities lead to an increase in the level of carbon dioxide in the Earth’s atmosphere?

A. (i), (ii) and (iii)  
B. (i), (ii) and (iv)  
C. (ii), (iii) and (iv)  
D. (ii), (iv) and (v)
32. The diagram below shows an ecosystem set up by Mary in the laboratory:

To test whether it is a balanced ecosystem or not, Mary

A. needs to pump air into the water.
B. needs to feed the shrimps occasionally.
C. needs to illuminate the set-up by light.
D. does not need to do anything more.

33. The mode of nutrition of decomposers is

A. holozoic nutrition.
B. saprophytic nutrition.
C. parasitic nutrition.
D. chemosynthetic nutrition.
34. The diagram below shows a food web:

If there is a large increase in the number of mouse, the insect larva population
A. will increase.
B. will decrease.
C. will remain about the same.
D. cannot be predicted.

35. When the skin is infected by bacteria, the infected area will become swollen because
A. a lot of bacteria accumulate there.
B. the blood capillaries dilate.
C. there is an accumulation of tissue fluid.
D. the concentration of antibodies increases.
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Questions 36 and 37 refer to the following information:

Paper discs containing antibiotics P, Q, R and S were placed on a culture of bacteria isolated from the mucus of a patient suffering from bronchitis. The results are:

36. What antibiotic(s) should the doctor prescribe for the patient to get the best result?
   A. use either P or Q
   B. use either R or S
   C. use P and Q together
   D. use R and S together

37. Which of the following actions should the patient take?
   A. He should try another doctor to see if he gets the same antibiotic(s) before he takes it / them.
   B. He should stop taking the antibiotic(s) as soon as his coughing stops.
   C. He should not take any other antibiotic without consulting the doctor.
   D. He should not consult the same doctor again if he has any side effects after taking the antibiotic(s).
38. The diagram below shows a vertical section of the human brain:

After a car accident, a man found difficulty in controlling his muscular coordination and balance. Which part of his brain may be injured?
A. 1
B. 2
C. 3
D. 4

39. Visual purple is found in the
A. pupil.
B. lens.
C. retina.
D. cornea.
40. The diagram below shows the different areas of the tongue sensitive to sweet, sour, salty and bitter tastes:

The area of the tongue which is most sensitive to bitter taste is

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

41. Which of the following combinations is correct?

<table>
<thead>
<tr>
<th>Sense organ</th>
<th>Receptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Tongue</td>
<td>thermoreceptors</td>
</tr>
<tr>
<td>B. Nose</td>
<td>nostrils</td>
</tr>
<tr>
<td>C. Ear</td>
<td>sensory hair cells</td>
</tr>
<tr>
<td>D. Eye</td>
<td>tear gland</td>
</tr>
</tbody>
</table>

42. Which of the following is the correct route of water-soluble digested products being transported to the heart from the site of absorption?

A. Villi → hepatic portal artery → liver → hepatic vein → vena cava → heart  
B. Villi → hepatic portal vein → liver → hepatic vein → vena cava → heart  
C. Villi → lacteal → hepatic portal vein → liver → vena cava → heart  
D. Villi → hepatic vein → liver → lacteal → lymph vessel → heart
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43. Which of the following will change if the heart rate increases?

A. The duration of diastole.
B. The duration of atrial systole.
C. The duration of ventricular systole.
D. Both the duration of atrial systole and ventricular systole.

44. Which of the following can lead to the decrease in blood pressure?

A. Increase in cardiac output
B. Vasoconstriction
C. Blood vessels blocked by cholesterol
D. Decrease in blood volume.

45. What can be absorbed in the large intestine?

A. Dietary fibre and cholesterol
B. Amino acid and glucose
C. Glycerol and monoglyceride
D. Water and vitamin K
PART B: Short Question

1. (4 marks)
   Shown below is the chemical structure of a compound known as benzaldehyde. This compound is a major component of the scent of almonds.

   ![Chemical Structure of Benzaldehyde](image)

   (a) Give the chemical structure of the product obtained if benzaldehyde is oxidized by an oxidizing agent.
   (b) Give the chemical structure of the product obtained if benzaldehyde is reduced by a reducing agent.
   (c) The three C–C \( \pi \)-bonds are delocalized in the 6-membered benzene ring. What is the advantage of \( \pi \)-bond delocalization?
   (d) How would the molecule structure of the compound tell you about whether the three \( \pi \)-bond are delocalized or not?

2. (2 marks)
   A sample contained CaCO\(_3\) and impurity. Back-titration was carried out to determine the CaCO\(_3\) content and the following results were obtained.
   - 1 g of the sample was completely dissolved in 50 cm\(^3\) of 0.1 M phosphoric acid (H\(_3\)PO\(_4\)).
   - 45 cm\(^3\) of 0.2 M NaOH solution was used to titrate the resulting solution.
   Calculate the percentage of CaCO\(_3\) in the sample. (Given: molar mass of CaCO\(_3\) = 100 g/mol)
3. (4 marks)
According to European standard, the maximum soluble migrated lead in a toy sample is 90 mg/kg. In a toy testing experiment to analyze the migration of lead, a toy sample weighed 0.5000 g was put into a flask. 25.00 mL 0.25% HCl was added to the flask. The flask was covered with paraffin. It was then put into a 37°C water bath to shake for 1 hour and was allowed to stand for another hour. The solution in the flask was filtered and cooled to room temperature. It was analyzed by an advanced instrument and was found to contain 2 mg of lead per liter of solution. (4 marks)

(a) Calculate the amount of lead (mg/kg) in the toy sample.
(b) State whether the sample can fulfill the standard requirement.
(c) Explain why the sample was put into a 37°C water bath to shake for 1 hour and was allowed to stand for another hour during the sample treatment.

4. (5 marks)
In the circuit shown, determine

(a) the equivalent resistance of the network between X and Y, and
(b) the current passing through all the resistors if a battery of e.m.f. 8 V and negligible internal resistance is connected across XY.
5. (5 marks)
Suppose you wish to use a mirror as a projector, to illuminate a small object of height 1 cm, and display the image on a screen at a size of 1 m where the distance to the screen is 4 m.

(a) What kind of mirror should you use? (Concave or convex)

(b) By applying the magnification equation: \[ M = \frac{h_i}{h_o} = -\frac{d_i}{d_o} \], and the mirror equation: \[ \frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f} \], determine the focal length (f) of the mirror.

6. The photograph below shows the lateral view of a human brain:

(a) The surface of cerebrum is highly folded. State the importance of this feature. (1 mark)
(b) Name structure Y and state one of its functions. (1.5 marks)
(c) What body function would be affected if brain damage occurred in area Z? (0.5 mark)
(d) (i) Which area of cerebrum control voluntary movement of limbs? (0.5 mark)
   (ii) Which area of cerebrum produce the sensation of pain? (0.5 mark)
7. The effect of two antibiotics X and Y on the growth of a bacteria was studied. The bacteria was first inoculated onto the surface of an agar plate. Then, four paper discs soaked in different concentrations of X and Y were placed onto the agar surface. Then the agar plate was incubated in $37^\circ$C for 48 hours and the results were as shown in the diagram below:

(a) What are antibiotics? Give one example. (1.5 marks)

(b) Which antibiotics, X or Y, is more effective in treating the disease caused by this bacteria? Explain your answer. (1.5 marks)

(c) Suggest one precaution to be taken by patients when taking antibiotics. (1 mark)