



UNIVERSITI KUALA LUMPUR  
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

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FINAL EXAMINATION  
OCTOBER 2025 SEMESTER

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COURSE CODE : HDB10703  
COURSE TITLE : INTRODUCTORY CLINICAL LABORATORY SCIENCE  
PROGRAMME NAME : BACHELOR OF BIOMEDICAL SCIENCE (HONOURS)  
DATE : 26 JANUARY 2026  
TIME : 9:00AM - 12:00PM  
DURATION : 3 HOURS



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INSTRUCTIONS TO CANDIDATES

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1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Answer ALL questions for Section A.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet.  *Tick if applicable*
9. Refer to the attached Formula/ Appendies.  *Tick if applicable*

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THERE ARE 17 PAGES OF QUESTIONS INCLUDING THIS PAGE

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**SECTION A (Total: 40 marks)**

**Answer ALL questions.**

**Please use the answer booklet provided.**

1. You receive a blood sample that requires a complete blood count (CBC) analysis. Which laboratory department should the sample be sent to?
  - A. Histopathology
  - B. Hematology
  - C. Immunology
  - D. Microbiology
  
2. You need to dispose of 100 mL of expired 1M hydrochloric acid (HCl). Which container should you use?
  - A. Sink with running water
  - B. Trash bin
  - C. Biohazard bag
  - D. Designated acid waste container
  
3. You are preparing a 0.5 L solution and the protocol requires measurements in milliliters (mL). Calculate the volume in mL.
  - A. 5000 mL
  - B. 500 mL
  - C. 5 mL
  - D. 50 mL

4. You need to prepare 1 mole of sodium chloride (NaCl). Given its molecular weight is 58.44 g/mol, which of the following masses should be weighed?
- A. 58.44 g
  - B. 5.844 g
  - C. 29.22 g
  - D. 116.88 g
5. Calculate the volume of diluent required to prepare a 1:5 dilution if you have 2 mL of stock solution.
- A. 2 mL
  - B. 5 mL
  - C. 8 mL
  - D. 10 mL
6. You measure a sample's concentration as 0.0250 M. Which of the following represents the correct number of significant figures in the measured value?
- A. 2
  - B. 3
  - C. 4
  - D. 6
7. Select the correct equipment for measuring exactly 2.5 grams of powder.
- A. Analytical balance
  - B. Top-loading balance
  - C. Spring scale
  - D. Graduated cylinder

8. Which piece of glassware is most appropriate for accurately measuring 25.0 mL of a liquid reagent?
- A. Test tube
  - B. Erlenmeyer flask
  - C. Beaker
  - D. Graduated cylinder
9. Which combination of components is most appropriate for preparing a buffer solution required to maintain a pH of 7.4 for an enzyme assay?
- A. Distilled water only
  - B. Concentrated acid only
  - C. Strong acid and strong base
  - D. Weak acid and its conjugate base
10. While viewing a stained blood smear under a light microscope using the 100x objective, the image appears blurry. Which of the following knobs should be adjusted first?
- A. Stage controls
  - B. Diaphragm lever
  - C. Fine focus
  - D. Condenser adjustment
11. Select the weak acid–conjugate base pair suitable for preparing a buffer at pH 4.0 ( $pK_a \approx 4$ ).
- A. Phosphoric acid / Dihydrogen phosphate ( $pK_a$  2.14)
  - B. Glycine ( $pK_a$  2.34)
  - C. Carbonic acid / Bicarbonate ( $pK_a$  6.1)
  - D. Acetic acid / Acetate ( $pK_a$  4.76)

12. Which of the following is a qualitative analysis?
- A. Calculating molarity
  - B. Measuring glucose concentration
  - C. Determining the pH
  - D. Identifying ions in a solution
13. A specimen is being observed microscopically at 400X total magnification, but more detail is required. Which of the following is the appropriate action to achieve higher resolution?
- A. Move the stage closer to the objective
  - B. Switch to the 10X objective and adjust the light
  - C. Increase light intensity
  - D. Add immersion oil and switch to the 100X objective
14. The function of the coarse adjustment knob of a microscope is to \_\_\_\_\_.
- A. adjust light intensity
  - B. fine-tune the focus
  - C. move the stage
  - D. focus the image roughly
15. A set of measurements that are close to each other but far from the true value demonstrate \_\_\_\_\_ accuracy and \_\_\_\_\_ precision.
- A. low; low
  - B. high; low
  - C. low; high
  - D. high; high

16. 1 mL of stock solution should be mixed with \_\_\_\_\_ mL of diluent to achieve a 1:20 dilution.
- A. 19
  - B. 21
  - C. 20
  - D. 40
17. Determine the appropriate initial action when a quality control (QC) sample yields results outside the acceptable range.
- A. Recalibrate the instrument
  - B. Replace the reagents
  - C. Release patient results
  - D. Repeat the quality control measurement
18. A sample exhibits an absorbance exceeding the instrument's measurable range. Determine the appropriate corrective action.
- A. Dilute the sample
  - B. Increase the wavelength
  - C. Decrease the temperature
  - D. Recalibrate the instrument

19. Choose the statements that describe the functions of a spectrophotometer.
- I. Quantifies dissolve substance
  - II. Measures known particles in a solution mixture
  - III. Determines the chemical bonding of a mixture of substance
  - IV. Identify materials based on their absorption and transmission of a specific wavelength
- A. I, II and IV only
  - B. I, II and III only
  - C. II, III and IV only
  - D. I, II, III and IV
20. Scanning electron microscopy (SEM) and transmission electron microscopy (TEM) are techniques that utilize the electron microscope. Identify the major difference between SEM and TEM.
- A. SEM requires less sample preparation than TEM
  - B. TEM produces coloured images due to its high-resolution magnification
  - C. SEM produces surface images of the specimen
  - D. TEM uses high-magnifying quartz lenses to focus electrons
21. A spectrophotometer is used to measure light absorbance in a solution. Select the correct path of light as it travels through a spectrophotometer.
- A. Photometer → cuvette → entry slit → spectrophotometer → exit slit
  - B. Spectrophotometer → entry slit → exit slit → cuvette → photometer
  - C. Photometer → spectrophotometer → entry slit → cuvette → exit slit
  - D. Spectrophotometer → entry slit → cuvette → exit slit → photometer

22. Significant figures in laboratory measurements indicate the \_\_\_\_\_.
- A. simplified calculation process
  - B. calculation of the measurement
  - C. precision of the measurement
  - D. performance of the measurement
23. The pH scale is defined from a \_\_\_\_\_.
- A. linear scale that represents temperature changes
  - B. logarithmic scale measurement of the salt concentration
  - C. linear scale measurement of the solution density
  - D. logarithmic scale that indicates the concentration of hydrogen ions
24. Which part of the microscope is responsible for controlling the intensity of light that reaches the specimen?
- A. Objective lens
  - B. Ocular lens
  - C. Condenser
  - D. Iris diaphragm
25. The total magnification of a microscope is calculated by multiplying the magnification of the ocular lens by the magnification of the \_\_\_\_\_.
- A. objective lens
  - B. nosepiece
  - C. condenser
  - D. iris diaphragm

26. If a specimen appears to be 8 mm long under a microscope magnification of 400x, its actual length is \_\_\_\_\_.
- A. 50  $\mu\text{m}$
  - B. 0.02 mm
  - C. 20  $\mu\text{m}$
  - D. 0.05 mm
27. Which type of microscope is most suitable for viewing the internal structures of a virus?
- A. Compound light microscope
  - B. Phase-contrast microscope
  - C. Scanning electron microscope
  - D. Transmission electron microscope
28. The prefix "micro" corresponds to \_\_\_\_\_.
- A.  $10^{-6}$
  - B.  $10^{-9}$
  - C.  $10^{-12}$
  - D.  $10^{-3}$
29. Random error is characterized by \_\_\_\_\_.
- A. consistent deviation
  - B. human mistake
  - C. instrument drift
  - D. unpredictable variation

30. Identify the volume of diluent needed to combine with 2 mL of stock solution to obtain a 1:5 dilution.
- A. 10 mL
  - B. 12 mL
  - C. 8 mL
  - D. 15 mL
31. Which light source is commonly used in a spectrophotometer for measuring absorbance in the UV range?
- A. Tungsten
  - B. Mercury
  - C. Halogen
  - D. Deuterium
32. According to Beer-Lambert's Law, absorbance is directly proportional to \_\_\_\_\_.
- A. wavelength of light
  - B. transmittance
  - C. temperature of the solution
  - D. path length and concentration
33. Which of the following is a post-analytical error?
- A. Using expired reagents
  - B. Mislabeling a specimen
  - C. Instrument calibration error
  - D. Transcribing results incorrectly

34. Which micropipette part is used to discard the tip after use?
- A. Ejector button
  - B. Shaft
  - C. Plunger
  - D. Volume adjustment dial
35. Which pipette type is most accurate for delivering a fixed volume of 25 mL?
- A. Pasteur pipette
  - B. Micropipette
  - C. Graduated pipette
  - D. Volumetric pipette
36. Which of the following is a qualitative measurement?
- A. pH of a solution
  - B. Volume of a liquid
  - C. Weight of a sample
  - D. Colour of a precipitate
37. In the reaction  $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$ , the conjugate base of HCl is \_\_\_\_\_.
- A.  $\text{H}_2\text{O}$
  - B.  $\text{OH}^-$
  - C.  $\text{Cl}^-$
  - D.  $\text{H}_3\text{O}^+$

38. Calculate the volume of 1 M sodium chloride (NaCl) stock solution required to prepare 250 mL of 0.2 M NaCl.
- A. 200 mL
  - B. 100 mL
  - C. 25 mL
  - D. 50 mL
39. Which of the following is the Bronsted acid / conjugate base in  $\text{H}_3\text{CO}_3 + \text{H}_2\text{O} \rightarrow \text{HCO}_3^- + \text{H}_3\text{O}^+$  reaction?
- A.  $\text{H}_2\text{CO}_3$  and  $\text{H}_2\text{O}$
  - B.  $\text{H}_2\text{O}$  and  $\text{H}_3\text{O}^+$
  - C.  $\text{H}_3\text{O}^+$  and  $\text{H}_2\text{CO}_3$
  - D.  $\text{HCO}_3^-$  and  $\text{H}_2\text{CO}_3$
40. Determine the volume of a 5.0 M calcium chloride ( $\text{CaCl}_2$ ) stock solution needed to prepare 250 mL of a 0.5 M  $\text{CaCl}_2$  solution.
- A. 100 mL
  - B. 25 mL
  - C. 2.5 mL
  - D. 50 mL

**SECTION B (Total: 60 marks)**

**Answer THREE (3) questions only.**

**Please use the answer booklet provided.**

**Question 1**

A bright-field microscope, also known as a light microscope, is commonly used in clinical and biological laboratories. Identify TEN (10) components of a standard bright-field microscope and explain the function of each component. Your answer must use scientific terminology and demonstrate an understanding of how each part contributes to image formation.

(20 marks)

## Question 2

- (a) You are required to prepare 250 mL of a 0.02 M aqueous sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) solution from a solid stock.
- Calculate the mass (in grams) of sodium carbonate needed.  
(Molar mass: Na = 23.0, C = 12.0, O = 16.0  $\text{g mol}^{-1}$ ).  
(4 marks)
  - Explain the precise step-by-step laboratory procedure for preparing this standard solution using only an analytical balance, a volumetric flask, a funnel, and deionized water. Ensure that no other instrument or laboratory apparatus is mentioned. Include all specific steps and clearly state when each of the listed apparatus is used.  
(6 marks)
- (b) A laboratory technician has a 4.0 M stock solution of hydrochloric acid (HCl). She needs to prepare 300 mL of a 0.5 M HCl solution for an experiment. However, she inadvertently uses a 350 mL volumetric flask and brings the solution to the calibration mark, resulting in a final volume of 350 mL instead of 300 mL.
- Calculate the actual concentration of the HCl solution when 350 mL is prepared instead of 300 mL.  
(4 marks)
  - Calculate the number of moles of HCl contained in 300 mL of the correctly prepared solution.  
(3 marks)
  - If she further dilutes 100 mL of the prepared 0.5 M HCl solution to 0.1 M, calculate the final volume required.  
(3 marks)

## Question 3

- (a) Calculate the pH of a 0.025 M solution of hydrochloric acid (HCl).

(5 marks)

- (b) A buffer solution is prepared by mixing 100 mL of 0.1 M acetic acid ( $\text{CH}_3\text{COOH}$ ,  $\text{pK}_a = 4.76$ ) with 100 mL of 0.15 M sodium acetate ( $\text{CH}_3\text{COONa}$ ). Calculate the initial pH of this buffer solution.

(15 marks)

**Question 4**

You are the Senior Medical Laboratory Scientist in charge of safety training for the Haematology department. A new laboratory assistant, Alex, has just joined your team. On Alex's first day, you are conducting an orientation. Based on this scenario, answer the following questions:

- (a) While introducing Alex to the lab, you point out different workstations. Name the primary laboratory department responsible for each of the following common tests or specimens:
- i. Analyzing a throat swab for bacterial infection. (1 mark )
  - ii. Performing a Full Blood Count (FBC). (1 mark )
  - iii. Testing a blood sample for sodium and potassium levels. (1 mark )
  - iv. Performing a routine urinalysis (e.g., with a dipstick). (1 mark )
  - v. Examining a stool sample for parasites. (1 mark )
  - vi. Determining a patient's blood group (e.g., A, B, O, AB). (1 mark )
  - vii. Processing a tissue biopsy to make microscope slides for cancer diagnosis. (1 mark )
  - viii. Performing a pregnancy test on a urine sample. (1 mark )
- (b) You give Alex the laboratory's Safety Manual. State TWO (2) key information that Alex must locate in this manual before starting any practical work. (4 marks)

- (c) Alex will be processing blood samples. Identify ONE (1) biological hazard and ONE (1) chemical hazard specifically associated with this task.

(4 marks)

- (d) During the safety training orientation, Alex encountered several hazard pictograms in the laboratory. For each pictogram, identify the associated hazard and describe a laboratory precaution.

i.

*Refer Below - Figure1 : Pictogram A.*

(2 marks)



Figure 1: Pictogram A

ii.

*Refer Below - Figure2 : Pictogram B.*

(2 marks)



Figure 2: Pictogram B

END OF EXAMINATION PAPER



