UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION

MARCH 2025 SEMESTER

COURSE CODE	:	HDB40103
COURSE TITLE	:	TRANSFUSION SCIENCE AND BLOOD BANKING
PROGRAMME NAME	:	BACHELOR OF BIOMEDICAL SCIENCE (HONOURS)
DATE	:	21 JUNE 2025
TIME	:	9:00AM - 12:00PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

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*

THERE ARE 21 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 40 marks)

Answer ALL questions.

Please use the answer booklet provided.

1. Before conducting ABO and Rh D typing of a patient's sample, what pre-analytical procedures should a blood banking technologist adhere to ensure accuracy and safety?
    I. Validate patient data and sample integrity.
    II. Conduct quality control assessments on reagents.
    III. Dispose all lipemic or hemolyzed specimens regardless of the cause.
    IV. Ensure that the temperature of all samples remains under 10 °C.

    A.   II and III only

    B.   I and IV only

    C.   I and II only

    D.   III and IV only

2. Which of the following statements is true regarding the direct antiglobulin test (DAT)?

    A.   It assesses the presence of unexpected antibodies in the donor's blood.

    B.   It measures the levels of haemoglobin in the recipient's serum.

    C.   It detects irregular antibodies in the patient's serum.

    D.   It is performed to detect the sensitization of irregular antibodies, proteins, or drugs against the patient's red blood cells.

3. During a discussion, a blood banking technologist is exploring methods for removing intact antibodies from red cell membranes. Which of the following techniques achieves this objective?

    A.   Neutralization

    B.   Elution

    C.   Auto-adsorption

    D.   Enzyme pre-treatment

4. A 33-year-old man has been diagnosed with autoimmune hemolytic anemia, and testing reveals the presence of a warm autoantibody. Why is it important to conduct further tests on his sample?

    A. To verify the antibodies coating the red cells.

    B. To identify potential underlying alloantibodies.

    C. To verify the presence of agglutinins.

    D. To identify the RBC units that are compatible with the autoantibody.

5. In the case of a neonate born at 35 weeks gestation developing severe hyperbilirubinemia necessitating treatment, which intervention would be suitable for managing the neonate's condition?

    A. Whole blood less than 10 days old should be used.

    B. Whole blood with anti-CMV (cytomegalovirus) positive could be used.

    C. Double volume exchange of whole blood should be given.

    D. When mother is not available, IAT cross match should be done with neonate's serum.

6. In a female patient with acute leukemia, platelet concentrates were administered to address low platelet counts. After receiving four units of platelet transfusion, the patient's platelet count increased from 3×10^9/L (3,000/µL) to 8×10^9/L (8,000/µL). Which of the following statements is true about her platelet transfusion?

    A. She has platelet refractoriness which may be caused by the antibodies against the platelets.

    B. She has disseminated intravascular coagulopathy (DIC) which causes thrombocytopaenia.

    C. She has platelet autoantibodies.

    D. Her platelet level increases appropriately.

7. A 26-year-old woman is being transfused with 1 unit of red cell concentrate. After being given 20 ml of blood, she complained of fever with chills and rigors, with body ache, and nausea. Which of the following actions should be done immediately by the attending doctor?

    A. Give the patient paracetamol for her condition.

    B. Stop the blood transfusion and discard the unit.

    C. Take urine sample for culture.

    D. Stop the blood transfusion and send sample for compatibility testing.

8. Following a blood transfusion, a patient develops a high fever and is subsequently diagnosed with a bacterial infection. Which of the following blood components is most likely to have been given to the patient?

    A. Fresh frozen plasma

    B. Cryoprecipitate

    C. Red cell concentrates

    D. Platelet concentrates

9. After receiving a blood transfusion, a patient experiences difficulty breathing 2 hours later. Which of the following statements indicates transfusion-related acute lung injury (TRALI) rather than transfusion-associated circulatory overload (TACO)?

    A. Post-transfusion serum samples indicate a positive result in the antiglobulin test (DAT).

    B. The patient is being administered a substantial quantity of packed red blood cell concentrates.

    C. The patient is in the elderly age group, over 70 years old.

    D. Despite undergoing medication and therapy, the patient's condition showed limited improvement.

10. Mr. Hisyam, a 46-year-old patient, is scheduled to receive a red cell transfusion. Which of the following scenarios would indicate the use of a blood warmer during the transfusion?

   A. He has hemolytic disease.

   B. He has cold agglutinin disease.

   C. He has acute polycythemia.

   D. He experiences sudden hyperthermia.

11. During investigation, a blood banking technologist finds multiple antibodies in a patient's plasma. Among these antibodies, which one can be eliminated through papain treatment?

   A. Anti-I

   B. Anti-Jka

   C. Anti-c

   D. Anti-Fya

12. A patient has a positive antibody screen and positive results against cells in the antibody panel. The patient specimen is retested with antibody panel cells that have been treated with the enzyme "ficin". The antibody no longer reacts against cells in the antibody panel. Which of the following antibodies is the most consistent with these results?

   A. Anti-K

   B. Anti-D

   C. Anti-Lea

   D. Anti-Fya

13. A 45-year-old male patient presents with symptoms of hemolytic anemia and neurological issues. Blood typing reveals a Kell-negative phenotype. Further investigation suggests a lack of Kx antigen. What is the likely diagnosis this patient?

   A.   Hemolytic uremic syndrome

   B.   McLeod syndrome

   C.   Kell-null syndrome

   D.   Autoimmune hemolytic anemia

14. A 25-year-old man had bruises on his chest and his platelet count was 4×10^9/L. He requires to undergo bone marrow aspiration and biopsy. What should be done for him?

   A.   He should be given platelets concentrates to raise it up to $> 20 \times 10^9$/L.

   B.   He should be given platelets to raise it to 100×10^9/L.

   C.   He should be given PRC, 4 units of random platelets, and 1 unit of plasma.

   D.   He should be transfused with platelets and plasma.

15. Which of the following testing approaches is the most reliable for identifying individuals with a weak D phenotype?

   A.   ABO blood grouping.

   B.   Molecular testing for RHD gene mutations.

   C.   Direct antiglobulin test (DAT).

   D.   Indirect antiglobulin test (IAT).

16. Which of the following is a key aspect of the International Society of Blood Transfusion (ISBT) Code of Ethics concerning informed consent?

   A.   Prioritizing consent from donors with higher social status.

   B.   Disregarding consent in emergency transfusion situations.

   C.   Obtaining consent only from legal guardians.

   D.   Ensuring donors are adequately informed and consent voluntarily.

17. A 20 year-old individual suspected of having the Bombay phenotype undergoes testing with anti-A, anti-B, and anti-H anti-sera. What potential result could be observed?

    A. Negative reaction with anti-A and anti-B anti-sera, positive with anti-H anti-sera.

    B. Negative reaction with all anti-sera.

    C. Positive reaction with all anti-sera.

    D. Positive reaction with anti-A and anti-B anti-sera, negative with anti-H anti-sera.

18. A blood bank technologist observes a discrepancy in the ABO blood typing reactions on a gel card. Which of the following characteristics is more indicative of weak subgroup A compared to typical A blood typing reactions?

    A. Slower reaction development with anti-A antisera.

    B. Faster reaction development with anti-A antisera.

    C. Increased intensity of reactions with anti-A antisera.

    D. Reduced intensity of reactions with anti-A antisera.

19. Compared to the A1B blood group, how might the Anti-A1 (lectin) gel card reaction differ in A2B blood group individuals?

    A. The A2B blood group shows a stronger reaction with Anti-A1

    B. The A2B blood group shows no reaction with Anti-A1

    C. The A2B blood group shows a delayed reaction with Anti-A1

    D. Both A1B and A2B show identical reactions with Anti-A1

20. Which of the following genes, besides RHD, are responsible for the production of Rh antigens?

    A. RhA and RhCE

    B. RhAG and RhCE

    C. RhA and RhB

    D. RhB and RhAG

21. Puan Juliana, a 33 year-old lady, has O positive blood phenotype with the R1R1 Rh genotype. She had received blood transfusions in her last pregnancy due to post-partum hemorrhage. Her indirect antiglobulin test (IAT) is positive. What is the most likely cause for the positive IAT?

    A.   The presence of Anti-Cw in her plasma

    B.   The presence of Anti-e in her plasma

    C.   The presence of Anti-c in her plasma

    D.   The presence of Anti-D in her plasma

22. Which of the following statements regarding red cell antigens are accurate?
    I. Antigens can be glycoproteins, polypeptides, or glycolipids.
    II. High-incidence antigens are present in 3% of the population.
    III. The frequency of high-incidence or low-incidence antigens varies by ethnicity.
    IV. The corresponding antibodies to these antigens are clinically insignificant.

    A.   I, II, and III only

    B.   II and IV only

    C.   I and III only

    D.   II, III, and IV only

23. Which of the following statements regarding the KEL blood group are accurate?
    I. The Kell locus is situated on chromosome 7.
    II. The predominant Kell phenotype among Malays is kk.
    III. The predominant Kell phenotype among Caucasians is Js(a-b+).
    IV. Kell antigens are susceptible to destruction by 2-mercaptoethanol (2-ME).

    A.   I, III, and IV only

    B.   I, II, and III only

    C.   II, III, and IV only

    D.   I, II, and IV only

24. A patient with anti-Jka receives Jka-positive blood during a blood transfusion. What would be the most probable consequence?

    A. The patient may exhibit a hemolytic transfusion reaction within a few hours.

    B. The patient is at risk of developing immediate mild fever.

    C. The patient is likely to experience minor allergic reactions.

    D. The patient may experience temporary discoloration at the injection site.

25. In regions with high malaria prevalence, which of the following individuals has low susceptibility to *Plasmodium vivax* infection?

    A. An 8-year-old boy who has the Duffy blood group Fy(a+b+).

    B. A 42-year-old woman who has the Duffy blood group Fy(a-b+).

    C. An 18-year-old girl who has the Duffy blood group Fy(a+b-).

    D. A 31-year-old man who has the Duffy blood group Fy(a-b-).

26. A patient with anti-Lea and anti-Leb antibodies needs a blood transfusion. Which explanation supports why any Lewis phenotype blood can be transfused to this recipient?

    A. Lewis antibodies are commonly found in the donor plasma.

    B. Lewis antibodies are non-reactive in transfusions.

    C. Lewis antigens are not present on red blood cells.

    D. Lewis antibodies are generally not clinically significant.

27. Kenneth, a regular donor, just received a tattoo. How long should he wait before being eligible to donate blood again?

    A. Seven days after getting the tattoo.

    B. A month after getting the tattoo.

    C. Six months post-tattoo, if there are no signs of infection.

    D. He cannot donate blood for a year following the tattoo application.

28. Cryoprecipitate is obtained from fresh frozen plasma within 6-8 hours of collection. What should be the expected levels of fibrinogen and FVIII in a bag of cryoprecipitate?

    A.   FVIII: 50-80 units/ bag and fibrinogen 150-250 mg/bag.

    B.   FVIII: 80-150 units/ bag and fibrinogen 150-250 mg/bag.

    C.   FVIII: 100-150 units/ bag and fibrinogen 100-250 mg/bag.

    D.   FVIII: 60-100 units/ bag and fibrinogen 80-100 mg/bag.

29. Which of the following parameters are correct for maintaining quality control of platelets?

    A.   Storage should be maintained at 37°C with continuous gentle agitation.

    B.   Storage should be maintained at 18-22°C with continuous strong agitation.

    C.   Storage should be maintained at 6-8°C with continuous strong agitation.

    D.   Storage should be maintained at 20-24°C with continuous gentle agitation.

30. Which of the following statements accurately describes pre-storage filtration for leukoreduction of packed red cells?

    A.   Pre-storage filtration effectively prevents cytomegalovirus (CMV) infection in recipients.

    B.   Pre-storage filtration exacerbates red cell storage lesions.

    C.   Pre-storage filtration decreases the expiration of red cells.

    D.   Pre-storage filtration has the capability to decrease the transmission of SARSCoV-2 infection.

31. Which of the following statements accurately describes Coombs Control Check Cells (CCC)?

   A. It enhances positive results in antigen-antibody reaction tests.

   B. The unsensitized RBC is used as one of the potentiators in the blood bank.

   C. The sensitized RBC is utilized to confirm a positive antigen-antibody reaction test.

   D. The sensitized RBC is utilized to validate a negative antigen-antibody reaction test.

32. What is the target for leukoreduction in packed red cells and apheresis platelets?

   A. $\leq 5x\ 10^6$ WBC / unit

   B. $\leq 9 \times 10^6$ WBC / unit

   C. $\leq 1 \times 10^8$ WBC / unit

   D. $\leq 3x\ 10^3$ WBC / unit

33. A blood banking technologist is conducting pre-transfusion testing. What is the purpose of performing a crossmatching test in blood transfusion?

   A. To confirm compatibility between donor blood and recipient plasma.

   B. To assess the patient's red blood cell count.

   C. To determine the patient's blood type.

   D. To identify the presence of unexpected antibodies in the patient's plasma.

34. Apheresis procedures are commonly used for _____.

   A. specific blood component collection

   B. routine blood donation

   C. donor whole blood collection

   D. emergency blood transfusions

35. What is the most frequently used anticoagulant in apheresis donation?

    A. Sodium citrate

    B. Heparin

    C. EDTA

    D. Acid citrate dextrose

36. Ms Elly requires therapeutic plasma exchange. What is the most likely indication for this procedure?

    A. She has excessive antibodies that could harm her.

    B. She has chronic hemochromatosis.

    C. She has severe anemia.

    D. She has bone marrow suppression due to infections.

37. What is the primary purpose of leukapheresis in therapeutic settings?

    A. To reduce the albumin concentration in plasma.

    B. To remove the excessive platelets in thrombocytosis.

    C. To remove malignant cells from breast cancer metastasis.

    D. To reduce the excessive white blood cells in hyperleucocytosis.

38. The hospital director aimed to establish a maximum blood ordering schedule. Utilizing the crossmatch to transfusion ratio (CTR) as a metric, what conclusion was reached regarding the appropriateness of blood requests?
Refer Below - Table1 : The crossmatch to transfusion ratio (CTR).

Table 1: The crossmatch to transfusion ratio (CTR)

Procedure	Number of operations	Units of blood cross-matched	Units of blood transfused	CTR
Caesarean Section	60	120	10	

A. The high CTR implies too many crossmatches but is necessary.

B. The low CTR is appropriate for the number of crossmatches.

C. The high CTR implies unnecessary crossmatches.

D. The low CTR suggests that more crossmatches should be performed.

39. Which of the following activities is related to the group, screen, and hold (GSH) procedure?

A. Blood group and screen recipient serum for antibodies.

B. Blood group recipient and screen donor's blood for antibodies.

C. Blood group recipient and crossmatch with group-specific blood.

D. Blood group recipient and perform saline phase crossmatch with group-specific blood.

40. A 46-year-old man is scheduled for coronary bypass (CBP) surgery with a haemoglobin level of 6.8 g/dl. What should be done to prepare him appropriately for the surgery?

    A. He should be transfused with PRC, plasma and platelets prophylactically before surgery.

    B. He should be transfused with packed red cells (PRC) before undergoing surgery.

    C. If he is stable, should go for CBP surgery without blood transfusion.

    D. He should be transfused with PRC and plasma to ensure he does not lose too much blood during surgery.

SECTION B (Total: 60 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

Rh and other blood grouping systems are vital in blood transfusions, organ transplants, and prenatal care, contributing significantly to safe medical practices.
Based on this information, answer the following questions.

(a)   The reactions depicted in the provided table result from testing red cells from a donor unit using Rh blood group system antisera.
   Refer Below - Table2 : The donor red cell's reactions with Rh blood group system antisera .

   Table 2: The donor red cell's reactions with Rh blood group system antisera

Rh anti sera	Donor RBC Reaction
Anti-D	+
Anti-C	0
Anti-E	+
Anti-c	+
Anti-e	0
Rh control	0
Note: + , agglutination; 0, no agglutination	

   i.   Determine two potential Rh genotypes of this donor using Fisher-Race and Wiener nomenclature.

(4 marks)

   ii.   Determine the most probable Rh genotype if the donor is of Chinese ethnicity.

(2 marks)

(b)   Mrs.Tan underwent an emergency cesarean section (EmCS). Her blood sample was sent to the blood bank for grouping, screening, and holding. The indirect antiglobulin (IAT) test yielded a positive result, indicating the presence of anti-M.

i. List five characteristics of anti-M antibody.

(5 marks)

ii. Following the EmCS, she was administered 2 units of packed red cells. The following day, her blood underwent testing once more, revealing a positive indirect antiglobulin test (IAT) and identifying the presence of anti-M and anti-S antibodies. What is the most probable phenotype of her red blood cells?

(2 marks)

iii. Can compatible blood be obtained for her if she needs a blood transfusion? Please provide a brief explanation.

(3 marks)

(c) Safety precautions during transfusion encompass various measures, such as rigorous screening of donors to prevent infection transmission.

i. Explain the strategies employed in modern blood bank systems to mitigate the risk of viral and bacterial transmission through blood transfusion.

(4 marks)

Question 2

A neonate presents with jaundice and severe anemia shortly after birth. The provided figure displays the blood test results of the neonate and the mother. Based on this information, answer the following questions.

Refer Below - Figure1 : The obtained blood testing findings of the neonate and the mother .
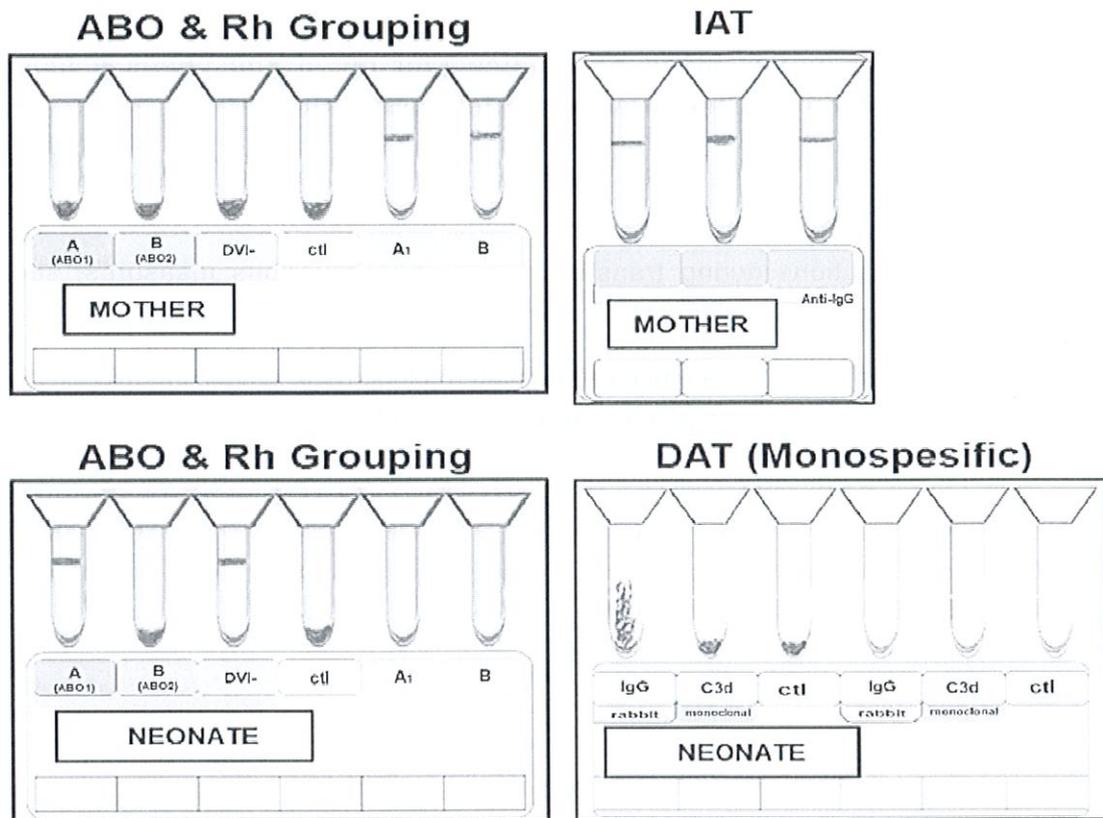
Figure 1: The obtained blood testing findings of the neonate and the mother

(a) Observe the readings of the above test results, record with correct grading for the ABO and Coombs test in the figure above.

(8 marks)

(b) State the blood group of the mother and her neonate.

(2 marks)

(c)   Suggest the possible cause of the neonate's jaundice and anemia.

(2 marks)

(d)   State the probable diagnosis for the neonate's condition.

(2 marks)

(e)   Briefly explain the probable diagnosis for the neonate's condition based on the obtained blood testing findings (given figure).

(6 marks)

Question 3

Pre-transfusion testing involves a set of laboratory examinations conducted on both the blood donor and recipient prior to a blood transfusion, ensuring a safe and successful procedure.

Based on the provided details, answer the following questions.

(a)   Compare the features of auto-antibodies and allo-antibodies.

(6 marks)

(b)   Puan Mariam, a 55-year-old mother of five, is set to undergo knee replacement surgery. She has undergone multiple surgeries in the past, some of which necessitated blood transfusions. However, there have been no procedures in the last four years. The blood bank received her blood sample along with instructions for crossmatching two units of red blood cells.

  i.   Based on the following result, identify the ABO & Rh blood group of Puan Mariam.
      Refer Below - Table3 : The ABO & Rh blood group results .

(2 marks)

Table 3: The ABO & Rh blood group results

Forward (Cell) Typing			Reverse (Serum) Typing	
Anti-A	Anti-B	Anti-D	A1 Cells	B Cells
0	4+	0	3+	0

  ii.   Based on the result of the antibody screening test below, identify three "unable to rule out" allo-antibodies.
      Refer Below - Table4 : The result of the antibody screening test .

(3 marks)

Table 4: The result of the antibody screening test

	Rh						MNS				LU		P	Kell		Duffy		Kidd		LISS		
	D	C	E	c	e	f	M	N	S	s	Lu^a	Lu^b	P_1	K	k	Fy^a	Fy^b	Jk^a	Jk^b	IS	37°C	IAT
1	+	+	0	0	+	0	+	+	+	+	0	+	+	+	+	+	+	0	+	0	0	2+
2	+	0	+	+	0	0	+	0	+	0	0	+	+	0	+	0	+	+	0	0	0	0
3	0	0	0	+	+	+	+	0	+	0	+	0	0	+	0	+	+	0	0	1+

iii. Based on the result of the antibody identification panel (tube method), identify the possible antibody. Explain the principles of antibody identification in the antigram.

Refer Below - Table5 : The result of the antibody identification panel (tube method) .

(4 marks)

Table 5: The result of the antibody identification panel (tube method)

	Rh						MNS				LU		P	Kell		Duffy		Kidd		LISS		
	D	C	E	c	e	f	M	N	S	s	Lu^a	Lu^b	P$_1$	K	k	Fy^a	Fy^b	Jk^a	Jk^b	IS	37°C	IAT
1	+	+	0	0	+	0	+	+	+	+	0	+	+	0	+	0	+	+	+	0	0	1+
2	+	+	0	0	+	0	+	+	+	0	0	+	0	0	0	+	+	+	+	0	0	1+
3	+	0	+	+	0	0	0	+	+	+	0	+	0	0	0	+	+	0	+	0	0	3+
4	+	0	0	+	+	+	+	+	0	+	0	+	+	+	0	0	0	0	+	0	0	3+
5	0	+	0	+	+	+	+	+	0	+	0	+	+	+	0	+	0	+	0	0	0	0
6	0	0	+	+	+	+	+	+	+	+	0	+	+	0	+	0	+	+	+	0	0	1+
7	0	0	0	+	+	+	+	+	0	+	0	+	+	+	0	0	+	0	+	0	0	3+
8	0	0	0	+	+	+	+	+	+	+	0	+	0	0	+	+	0	+	0	0	0	0
9	0	0	0	+	+	+	+	0	+	0	0	+	+	+	0	0	+	+	+	0	0	1+
10	0	0	0	+	+	+	0	+	0	+	0	+	+	0	+	+	0	0	+	0	0	3+
11	+	+	0	0	+	0	+	+	+	+	0	+	0	+	0	0	+	+	+	0	0	1+
AC																				0	0	0

(c) A 36-year-old man met with an accident and was rushed into surgery for intracerebral bleeding. During surgery, his estimated blood loss was 150 ml/minute. Four units of Safe O blood were available in the operating theater.

i. Define safe O blood and explain its main function in transfusion medicine.

(2 marks)

ii. Explain three limitations of utilizing the safe O blood as a universal donor, taking into consideration its compatibility and the risk of potential transfusion reactions.

(3 marks)

Question 4

Donor selection and the utilization of direct and indirect antiglobulin tests (DAT and IAT) are interlinked to ensure the compatibility and safety of blood transfusions.
Based on this information, answer the following questions.

(a) Briefly outline five principles of donor selection.

(5 marks)

(b) A 33-year-old woman wishes to donate her blood. Her last donation occurred 13 years ago, and she has had four previous pregnancies. She intends to donate plasma through apheresis donation. Do you reject this donor? Justify your answer.

(7 marks)

(c) Differentiate between DAT and IAT based on the criteria of pre-requisites and clinical applications.

(8 marks)

END OF EXAMINATION PAPER