Higher Specialist Diploma

Transfusion Science

Examination – September 2022

Short-answer questions

60 minutes

Attempt all four questions

<u>Instructions to candidates</u>

1. Record your candidate number and HSD discipline on the front sheet of the answer booklet

2. Record your candidate number, the question number and the page number in the spaces provided on the answer sheets

3. Begin each new answer on a new page

4. Each question is worth 25 marks

    Please note this question paper is not to be removed from the examination room.

1. A patient with Chronic Lymphocytic Leukaemia, known to your hospital, has been admitted to the Emergency department with symptoms of dizziness and severe shortness of breath. Following a low haemoglobin result of 56g/l, the ward contacts you and requests three red cells urgently.

    You try to locate the sample but find that is has been referred to the local Red Cell Immunohaematology department for investigation and crossmatch, as the antibody screen was positive. The patient's history shows that they were transfused three weeks prior and the following special requirement flags are shown:
    "Autoimmune Haemolytic Anaemia" and "positive direct antiglobulin technique"

    You contact the ward, who inform you that the patient has become unresponsive, and they need the blood now.

    Discuss your immediate and follow up actions, and the reasons for your decisions.

2. You receive a phone call from the Emergency Department to say that the satellite fridge, which contains four emergency O D Negative red cells, has been found with an "out of temperature error" but the alarm has been silenced. The current temperature reads "8°C" Explain and validate your actions.

3. A 32-year-old female patient arrives in the ED department with a PV (per vaginum) bleed. She is 28 weeks pregnant. When booking in their sample you notice a previous antibody flag for anti-f and anti-Lea.

    Your current sample groups as A D Positive with a positive antibody screen. The clinical team have asked for four units of red cells, what must you consider about this request, how will you proceed and what red cells will you provide?

4. You have received your NEQAS report for an antigen typing exercise, and you have received some penalty points. Here are the results that were submitted.

	Hub		Spoke 1		Spoke 2	
	Jka	Jkb	Jka	Jkb	Jka	Jkb
NEQAS Patient 1	+	-	+	-	+	-
	Jka	Jkb	Jka	Jkb	Jka	Jkb
NEQAS Patient 2	+	-	+	-	-	-

Critically evaluate all of the results, discuss any discrepancies and possible causes and explain your next steps as quality lead for Blood Transfusion.

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Essay Paper

Discipline-specific questions

120 minutes

Attempt 2 out of 5 questions

<u>Instructions to candidates</u>

1. Record your candidate number and HSD discipline on the front sheet of the answer booklet

2. Record your candidate number, the question number and the page number in the spaces provided on the answer sheets

3. Begin each new answer on a new page

4. Each question is worth 100 marks

1. Critically discuss the various pathways for antibody identification, monitoring and post-natal follow up in antenatal patients with red cell antibodies.

2. Evaluate the strategies and transfusion protocols that might be implemented for dealing with massive haemorrhage in both the pre-hospital and hospitalised patient settings.

3. With regards to legislation and accreditation, discuss various steps taken by the blood transfusion laboratory when introducing a new piece of equipment.

4. With constant threats to the blood supply, critically discuss the availability of alternatives to transfusion and the strategies aimed at ensuring the appropriate use of blood components.

5. Discuss the factors that need to be considered when developing a policy regarding the referral of samples for further investigation / confirmation by a reference service.

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CASE STUDIES

1. This seen case study will be the first question in the case studies examination.

2. There will be a further two unseen case studies in the examination.

3. Candidates should note that whilst they should spend time between the publication of the case study and the examination preparing their responses, they are **not** permitted to take any prepared answers into the examination room.

4. For these case study questions you are strongly advised to answer the questions as they arise during the case study to avoid later information impacting adversely on your answers to the earlier questions by presuming an "outcome".

PLEASE NOTE:
- Throughout this paper, unless otherwise stated in the question itself, where either antibody screening cells or antibody identification panel cells are shown, the cells are Lu(b+), Kp(b+) and Wr(a-).
- 'I', 'II' and 'III' are screening cells 1 and 2 and 3.
- 'Pap' stands for Papain-treated red cells.
- 'IAT' stands for indirect antiglobulin technique using untreated red cells.
- 'DAT' stands for direct antiglobulin technique.
- 'MF' stands for mixed-field.
- 'DP' stands for dual population

SEEN CASE STUDY

36 year old female admitted into emergency department with heavy PV (per vaginum) bleeding. She has a history of alcohol related cirrhosis of the liver and has received multiple electronically issued red cell transfusions over the last three years, but nothing in the last three months. A blood group and antibody screen is performed and three units of red cells have been requested urgently. The patient's results are shown below.

Blood Group

Anti-A	Anti-B	Anti-D1	Anti-D2	Control	A1 cells	B cells
4+	0	4+	4+	0	0	4+

Antibody Screen

Cell	Rh	C^w	C	c	D	E	e	M	N	S	s	P1	Lu^a	K	k	Kp^a	Le^a	Le^b	Fy^a	Fy^b	Jk^a	Jk^b	IAT
I	$R_1^wR_1$	+	+	-	+	-	+	-	+	-	+	-	-	-	-	+	-	-	+	-	-	+	**0**
II	R_2R_2	-	-	+	+	+	-	+	-	+	+	+	-	-	+	-	+	-	+	-	+	-	**0**
III	rr	-	-	+	-	-	+	+	+	+	-	+	+	+	+	-	-	+	-	+	+	+	**0**

Three A D Positive red cells are issued electronically. The first two red cells are transfused without incident. After approximately 60mls of the third unit has been administered, the patient experiences nausea, chills, back pain, arrhythmia, and tachycardia.

The transfusion is stopped, and the patient is examined. Her temperature has increased to 38.2°C her pulse is raised to 138 bpm and O2 saturation levels have dropped to 75 percent. The patient is transferred to the intensive care unit, where further blood samples are taken.

See below for pre and post transfusion results.

Full Blood Count and Biochemistry Studies

Parameter	Result (pre transfusion)	Result (post transfusion)	Reference range (adult female)
Haemoglobin (Hb)	52	70	130 - 180 g/L
White blood count (WBC)	15.6	19.6	$4.0 - 11.0 \times 10^9$/L
Platelet count	125	103	$150 - 450 \times 10^9$/L
Lactate dehydrogenase (LDH)	200	292	140 - 280 IU/L
Total Bilirubin	19	54	1 - 21 µmol/L

Blood Transfusion Serological investigations

Parameter	Result (pre transfusion sample)	Result (post transfusion sample)
Blood group	A D Positive	A D positive
Antibody screen (IAT)	Negative	Negative
DAT	Negative	Weak Pos (+)
Crossmatched first red cell unit by IAT with patient plasma	Compatible by IAT	Compatible by IAT
Crossmatched second red cell unit by IAT with patient plasma	Compatible by IAT	Compatible by IAT
Crossmatched third red cell unit by IAT with patient plasma	Incompatible by IAT	Incompatible by IAT

a. Critically evaluate ALL of the results shown for the patient, including the significance of each of the tests performed when a transfusion reaction is suspected?   (15 marks)

b. Discuss various reasons why nothing was detected in the routine pre transfusion testing?   (10 marks)

c. What can cause an 'incompatible' result when performing a serological crossmatch?   (15 marks)

d. What is the likely cause of this transfusion reaction and what further investigations might you suggest to confirm your suspicions?   (10 marks)

e. Discuss the original justification and process for both implementing and performing electronic issue, in light of this event. (15 marks)

f. The clinical team contacts you to discuss the cause of the incident, how will you explain your answer?   (5 marks)

g. One further unit of red cells is requested, how will you proceed and what preventative actions might you take to prevent a reoccurrence of this transfusion reaction for subsequent requests?   (10 marks)

h. The ward contact you to say that they suspect the patient might be pregnant, what are your concerns regarding the recent transfusion and pregnancy?   (10 marks)

i. Who is this incident reportable to and why?   (10 marks)

UNSEEN CASE STUDIES

2.

A 20-year-old male patient of Afro-Caribbean origin with sickle cell disease (Hb SS) arrives in the Emergency Department complaining of pain and tenderness bilaterally in his lower posterior legs and hips and a fever. He had recently been discharged from hospital after a sickle cell crisis, involving priapism, fever, and generalized pain where he had received two units of red cells, without incident. His blood group O D Positive (phenotype Ro) and has a '*clinically significant red cell antibody*' flag on his patient record.
See below for his Full Blood Count and Biochemistry Studies from his previous hospital stay 8 days ago (post transfusion) and todays admission.

Parameter	Result (Post transfusion 8 days ago)	Result (Today's presentation)	Reference range (adult female)
Haemoglobin (Hb)	81 g/L	38 g/L	130 - 180 g/L
White blood count (WBC)	15.7	19.8	4.0 -11.0 x 10^9/L
Platelet count	356	154	150 – 450 x 10^9/L
Total Bilirubin	6.8	14.5	1.7 – 5.1 mmol/L

Blood Group (today)

Anti-A	Anti-B	Anti-D1	Anti-D2	Control	A1 cells	B cells
0	0	DP	DP	0	4+	4+

Antibody Screen (today)

Cell	Rh	C^w	C	c	D	E	e	M	N	S	s	P1	Lu^a	K	k	Kp^a	Le^a	Le^b	Fy^a	Fy^b	Jk^a	Jk^b	IAT
I	$R_1^wR_1$	+	+	-	+	-	+	-	+	-	+	-	-	-	-	+	-	-	+	-	-	+	**0**
II	R_2R_2	-	-	+	+	+	-	+	-	+	+	+	-	-	+	-	+	-	+	-	+	-	**2+**
III	rr	-	-	+	-	-	+	+	+	+	-	+	+	+	+	-	-	+	-	+	+	+	**3+**

Panel Results (today)

Cell	Rh	C^w	C	c	D	E	e	M	N	S	s	P_1	Lu^a	K	k	Kp^a	Le^a	Le^b	Fy^a	Fy^b	Jk^a	Jk^b	IAT	Pap
1	$R_1^wR_1$	+	+	0	+	0	+	+	+	0	+	0	0	0	+	0	0	+	+	0	+	0	**0**	**0**
2	R_1R_1	0	+	0	+	0	+	+	0	+	0	3+	0	0	+	0	+	0	+	0	+	0	**3+**	**0**
3	R_2R_2	0	0	+	+	+	0	+	0	+	+	3+	0	+	+	0	0	+	0	+	0	+	**2+**	**0**
4	r'r	0	+	+	0	0	+	0	+	0	+	4+	0	0	+	+	0	+	+	0	+	+	**0**	**0**
5	r"r	0	0	+	0	+	+	0	+	+	+	0	0	0	+	0	0	0	+	+	0	+	**2+**	**0**
6	rr	0	0	+	0	0	+	+	+	+	0	4+	0	+	+	0	0	0	0	+	+	0	**3+**	**0**
7	rr	0	0	+	0	0	+	0	+	0	+	2+	0	+	+	0	0	0	+	+	+	+	**0**	**0**
8	rr	0	0	+	0	0	+	0	+	+	+	3+	0	0	+	0	0	+	+	+	0	+	**2+**	**0**
9	rr	0	0	+	0	0	+	+	+	0	+	0	+	0	+	0	+	0	0	+	0	+	**0**	**0**
10	rr	0	0	+	0	0	+	+	0	0	+	3+	0	+	0	+	+	0	+	+	+	0	**0**	**0**

a. Identify any red cell antibody(ies) present and any you cannot exclude. How did you arrive at your conclusion and how would you confirm it?   (20 marks)

b. The analyser cannot confirm the patient's blood group. Discuss the possible reasons for these results.   (10 marks)

c. Critically discuss all the full blood count and biochemistry results obtained, why they are significant in this case?   (15 marks)

d. What further serological tests would you carry out and why?   (10 marks)

It is day two of the patient's re-admission. Repeat samples are sent to the laboratory with a request for three red cells. You perform the blood group, antibody screen and antibody identification panel again. Here are your results.

Blood Group (new sample – day two of re-admission)

Anti-A	Anti-B	Anti-D1	Anti-D2	Control	A1 cells	B cells
0	0	DP	DP	0	4+	4+

Antibody Screen (new sample – day two of re-admission)

Cell	Rh	C^w	C	c	D	E	e	M	N	S	s	P1	Lu^a	K	k	Kp^a	Le^a	Le^b	Fy^a	Fy^b	Jk^a	Jk^b	IAT
I	$R_1^wR_1$	+	+	-	+	-	+	-	+	-	+	-	-	-	-	+	-	-	+	-	-	+	**0**
II	R_2R_2	-	-	+	+	+	-	+	-	+	+	+	-	-	+	-	+	-	+	-	+	-	**4+**
III	rr	-	-	+	-	-	+	+	+	+	-	+	+	+	+	-	-	+	-	+	+	+	**4+**

Panel Results (new sample – day two of re-admission)

Cell	Rh	C^w	C	c	D	E	e	M	N	S	s	P_1	Lu^a	K	k	Kp^a	Le^a	Le^b	Fy^a	Fy^b	Jk^a	Jk^b	**IAT**	**Pap**
1	$R_1^wR_1$	+	+	0	+	0	+	+	+	0	+	0	0	0	+	0	0	+	+	0	+	0	**3+**	**3+**
2	R_1R_1	0	+	0	+	0	+	+	0	+	0	3+	0	0	+	0	+	0	+	0	+	0	**4+**	**3+**
3	R_2R_2	0	0	+	+	+	0	+	0	+	+	3+	0	+	+	0	0	+	0	+	0	+	**2+**	**0**
4	r'r	0	+	+	0	0	+	0	+	0	+	4+	0	0	+	+	0	+	+	0	+	+	**2+**	**2+**
5	r"r	0	0	+	0	+	+	0	+	+	+	0	0	0	+	0	0	0	+	+	0	+	**2+**	**0**
6	rr	0	0	+	0	0	+	+	+	+	0	4+	0	+	+	0	0	0	0	+	+	0	**4+**	**3+**
7	rr	0	0	+	0	0	+	0	+	0	+	2+	0	0	+	0	0	0	+	+	+	+	**2+**	**2+**
8	rr	0	0	+	0	0	+	0	+	+	+	3+	0	+	+	0	0	+	+	+	0	+	**2+**	**0**
9	rr	0	0	+	0	0	+	+	+	0	+	0	+	0	+	0	+	0	0	+	0	+	**0**	**0**
10	rr	0	0	+	0	0	+	+	0	0	+	3+	0	+	0	+	+	0	+	+	+	0	**3+**	**3+**

e. Discuss any significant findings. (10 marks)

f. With regards to current guidance, what red cell specifications should patients with SCD receive and why? (10 marks)

g. What are the main goals for transfusing patients with Sickle Cell anaemia? (5 marks)

h. Considering the patients history, results and clinical presentation, provide a detailed explanation for their re-admission. (10 marks)

i. Discuss some of the complications you might see in transfusion-dependent sickle cell patients generally and how they can be managed (10 marks)

Question 3

The following results were obtained during a 28 week routine follow up antenatal appointment from a 26-year-old female patient. Previous blood group and antibody screen results have shown her to be A D Negative with a negative antibody screen. Her records also show that a fetomaternal haemorrhage estimation was performed following a PV (per vaginum) bleed at 23 weeks gestation.

Blood Group

Anti-A	Anti-B	Anti-D1	Anti-D2	Control	A1 cells	B cells
4+	0	0	0	0	1+	4+

Antibody Screen

Cell	Rh	C^w	C	c	D	E	e	M	N	S	s	P1	Lu^a	K	k	Kp^a	Le^a	Le^b	Fy^a	Fy^b	Jk^a	Jk^b	IAT
I	$R_1^wR_1$	+	+	-	+	-	+	-	+	-	+	-	-	-	-	-	-	-	+	-	-	+	**4+**
II	R_2R_2	-	-	+	+	+	-	+	-	+	+	+	-	-	+	-	+	-	+	-	+	-	**4+**
III	rr	-	-	+	-	-	+	+	+	+	-	+	-	+	+	-	-	+	-	+	+	+	**2+**

Panel Results

Cell	Rh	C^w	C	c	D	E	e	M	N	S	s	P_1	Lu^a	K	k	Kp^a	Le^a	Le^b	Fy^a	Fy^b	Jk^a	Jk^b	IAT	Pap
1	$R_1^wR_1$	+	+	0	+	0	+	+	+	+	0	0	0	0	+	0	0	+	+	0	+	0	4+	4+
2	R_1R_1	0	+	0	+	0	+	+	0	+	0	3+	0	0	+	0	+	0	+	0	+	0	4+	4+
3	R_2R_2	0	0	+	+	+	0	+	0	0	+	3+	0	+	+	0	0	+	0	+	0	+	4+	4+
4	r'r	0	+	+	0	0	+	0	+	0	+	4+	0	0	+	+	0	+	+	0	+	+	0	0
5	r"r	0	0	+	0	+	+	0	+	+	+	0	0	0	+	0	0	0	+	+	0	+	0	0
6	rr	0	0	+	0	0	+	+	+	0	+	4+	0	+	+	0	0	0	0	+	+	0	2+	0
7	rr	0	0	+	0	0	+	0	+	+	0	2+	0	+	+	0	0	0	+	+	+	+	0	0
8	rr	0	0	+	0	0	+	+	0	+	+	3+	0	0	+	0	0	+	+	0	0	+	3+	0
9	rr	0	0	+	0	0	+	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	0
10	rr	0	0	+	0	0	+	+	+	0	+	3+	0	0	0	0	+	0	+	+	+	0	2+	0
Auto	rr	/	0	+	0	0	+	/	/	/	/	/	/	0	/	/	/	/	/	/	/	/	/	0	0

a. Critically evaluate **all** the results provided. Identify any antibody(s) present and comment on any that cannot be excluded? Explain your answer. (15 marks)

b. Outline what further investigations you should undertake at this time and what follow up would you advise dependant on the outcome of those investigations? (15 marks)

c. You discuss the patient with the Maternity unit where they confirm that the patient refused any further treatment following her PV bleed at 23 weeks. With regards to this new information, what are your next steps? (15 marks)

d. Discuss, in detail, the mechanisms by which the antibodies identified can have a detrimental effect on the fetus. (15 marks)

e. Discuss, in detail, the treatment options available to prevent harm to the fetus. (10 marks)

f. What testing should be performed upon delivery of the baby and discuss why?   (10 marks)

g. Describe what red cells you would provide for this patient if she required blood during or after her pregnancy, explaining your rationale.   (10 marks)

h. If the fetus requires transfusion support in-utero or as an infant postnatally, what blood components would you provide and explain why?   (10 marks)