Higher Specialist Diploma

Transfusion Science

Examination – September 2021

Short-answer questions

60 minutes

Attempt all four questions

Instructions to candidates

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. You have been asked to review your annual results for the NEQAS feto-maternal haemorrhage estimation by acid elution for your quality meeting. This table represents data from the "hub" laboratory and its two "spoke" laboratories.

   It contains results from two test 'patients' for each exercise, along with your results and the mean results taken from all NEQAS participants.

NEQAS Exercise (Month)		**Hub (results in mls bleed)**	**Spoke 1 (results in mls bleed)**	**Spoke 2 (results in mls bleed)**	**NEQAS Participant average (mean)**
January	Patient 1	13.0	13.1	12.8	12.9
	Patient 2	<2.0	<2.0	<2.0	<2.0
March	Patient 1	4.4	4.5	4.6	4.5
	Patient 2	<20.0	<2.0	<2.0	<2.0
September	Patient 1	<2.0	<2.0	<2.0	<2.0
	Patient 2	7.7	7.9	7.8	7.7
December	Patient 1	18.9	19.4	9.2	19.1
	Patient 2	19.3	19.2	8.9	19.4

   a. Identify any anomalies within the results and critically evaluate what the possible causes could be? (15 marks)

   b. What actions should be taken next? (10 marks)

2. You receive a phone call from a nurse on a ward to inform you of a possible transfusion reaction to a unit of red cells, approximately after five minutes into the transfusion. The nurse tells you that the patient has spiked a temperature and feels unwell.

   Critically evaluate the immediate actions that should be taken and how you will investigate a suspected haemolytic transfusion reaction in the laboratory.

3. You are performing trend analysis for one weeks' worth of quality control data for two blood grouping analysers in your department. Here is your data for your QC sample one.

DAY	ANALYSER 1						ANALYSER 2					
	Blood group (forward) QC1 SAMPLE			Antibody screen QC1 SAMPLE			Blood group (forward) QC1 SAMPLE			Antibody screen QC1 SAMPLE		
	Anti-A	Anti-B	Anti-D1	Screen cell I	Screen cell II	Screen cell III	Anti-A	Anti-B	Anti-D1	Screen cell I	Screen cell II	Screen cell III
MON	4	0	4	3	3	0	4	0	4	3	3	0
TUES	4	0	4	3	3	0	4	0	4	3	3	0
WED	4	0	4	3	3	0	4	0	4	3	3	0
THURS	4	0	4	3	3	0	4	0	4	3	2	0
FRI	4	0	4	3	3	0	4	0	4	2	2	0
SAT	4	0	4	3	3	0	4	0	4	2	1	0
SUN	4	0	4	3	3	0	4	0	4	1	1	0

a. Evaluate your results. What are your concerns about these results and how could you test your theory? (15 marks)

b. Why is important to trend your QC? (10 marks)

4. A Paediatric specialist trainee sends a blood group and antibody screen sample to the laboratory for a patient. The request states:

"*New sickle cell patient – anaemia, ? for transfusion*"

a. The patient is an 8 year old female, with no previous local Blood Transfusion history. Discuss your next steps and what tests are you going to perform and why? (10 marks)

b. You have discovered the patient has the following phenotype.

ccDee, K negative, Fya negative, S negative, s negative

You receive a phone call requesting 2 units of red cells for the following day. Discuss what red cells you are likely to issue and why? (10 marks)

c. What are the potential complications associated with transfusing patients with SCD? (5 marks)

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Essay Paper

120 minutes

Attempt 2 out of 5 questions

Instructions to candidates

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

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3. Begin each new answer on a new page

4. Each question is worth 100 marks

1. Critically discuss the advantages and disadvantages of performing a feto-maternal haemorrhage estimation by acid elution and flow cytometry. Which method would you consider to be more clinically accurate and why?

2. Your Pathology service is considering purchasing a new laboratory information management system. With reference to current guidance and regulation, describe the requirements specific to Blood Transfusion and the approach you would take to the validation of a new computer system.

3. As part of the junior medical staff training programme, you are required to give a 20 minute presentation on 'The diagnosis and management of platelet refractoriness'. Outline the content of that presentation and critically discuss the importance of the information you have included.

4. Identify patient groups requiring components with special requirements, critically evaluate the significance of each requirement and discuss what systems are in place to ensure their provision.

5. Critically discuss the key methods that can be used to investigate and positively identify a clinically significant alloantibody.

Institute of Biomedical Science

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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.

SEEN CASE STUDY

1.
You receive a phone call from the Emergency Care Centre to activate the Major Haemorrhage Protocol for an unknown white European adult male patient having a suspected gastrointestinal bleed. They ask for four units of red cells.

a. What actions should you immediately take, what will you provide and critically evaluate the factors that you should consider for this request? (15 marks)

You issue four units of your chosen red cells. Ten minutes later the following samples arrive in the laboratory, which you process urgently; Full blood count, 2 x Blood group and antibody screen samples (taken by two different staff members), coagulation studies.

The results are shown below:

Blood group (*both samples provided same results*)

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

Antibody Screen (*both samples provided same results*)

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	$R_1^wR_1$	+	+	-	+	-	+	+	-	-	+	-	-	-	-	-	-	-	+	-	-	**+**	**2+**
II	R_2R_2	-	-	+	+	+	-	+	-	-	+	+	-	-	+	-	+	-	+	-	+	-	**3+**
III	rr	-	-	+	-	+	+	+	+	+	-	+	-	+	+	-	-	+	-	+	+	+	**0**

Full Blood Count and Coagulation Studies

Parameter	**Result**	**Reference range (adult male)**
Haemoglobin (Hb)	74	130 - 180 g/L
White blood count (WBC)	15.6	4.0 -11.0 x 10^9/L
Platelet count	76	150 – 450 x 10^9/L
Prothrombin time (PT)	27	9 – 13s
Activated Partial Prothrombin Time (APTT)	56	32 – 42s
Fibrinogen	0.8	2.0 – 4.0 g/L

b. Comment on ALL of the results and discuss their significance. (20 marks)

c. Based on the results previously provided, critically evaluate what components are required and discuss your evidence to support your choices. (15 marks)

Further investigations include an antibody identification panel.

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	**2+**	**0**
2	R_1R_1	0	+	0	+	0	+	+	0	+	0	3+	0	0	+	0	+	0	+	0	+	0	**3+**	**1+**
3	R_2R_2	0	0	+	+	+	0	+	0	+	+	3+	0	+	+	+	0	+	0	+	+	+	**0**	**0**
4	r'r	0	+	+	0	0	+	0	+	0	+	4+	0	0	+	0	0	+	+	0	0	+	**2+**	**0**
5	r''r	0	0	+	0	+	+	0	+	+	+	0	0	0	+	0	0	0	+	+	0	+	**1+**	**0**
6	rr	0	0	+	0	0	+	+	+	+	0	4+	0	+	+	0	0	0	0	+	+	0	**0**	**0**
7	rr	0	0	+	0	0	+	0	+	0	+	2+	0	0	+	0	0	0	+	+	0	+	**2+**	**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**	**0**
10	rr	0	0	+	0	0	+	+	+	0	+	3+	0	+	0	+	+	0	+	+	+	0	**1+**	**1+**
Auto	rr	/	0	+	0	0	+	/	/	/	/	/	/	0	/	/	/	/	/	/	/	/	**0**	**0**

d. What antibody(s) have been identified, describe any further testing that should be performed to confirm your findings. (10 marks)

You perform a Rh and K red cell phenotype

C	c	E	e	K	control
4+	4+	0	4+	4+	0

e. What is the most probable red cell Rh phenotype, explain your answer? (5 marks)

f. The patient has been transfused all four units of emergency red cells, what is the probability that the patient has been exposed to the corresponding antigen(s) that the patient has formed an antibody against? (5 marks)

g. Critically evaluate the actions now required, as a result of the answers given in d, e and f. (10 marks)

h. The clinical team have asked for four more units of red cells urgently, how do you proceed? (10 marks)

The following day, the patient is positively identified. New blood group and antibody screen samples are sent to the laboratory. The patient has a historical record in the computer along with a special requirement flag, indicating that they require irradiated products. This special requirement flag was entered two years previously. No irradiated products were issued to the patient the previous day.

i. With this new information, critically evaluate your next steps and whether this case requires reporting as an incident and if so to who and why? (10 marks)

UNSEEN CASE STUDIES

2.

You receive a group and antibody screen sample from a 28-year-old female with an antepartum haemorrhage (APH) at 24 weeks. You have a historical antenatal record for this patient from four years earlier on your computer system. There are no special requirement flags present within her historical record.

Blood Group

Anti-A	Anti-B	Anti-D1	Anti-D2	Control	A1 cells	B cells
4+	0	0	0	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	$R_1{}^wR_1$	+	+	-	+	-	+	+	-	-	+	-	-	-	-	-	-	-	+	-	-	**+**	**2+**
II	R_2R_2	-	-	+	+	+	-	+	-	-	+	+	-	-	+	-	+	-	+	-	+	-	**3+**
III	rr	-	-	+	-	-	+	+	+	+	-	+	-	+	+	-	-	+	-	+	+	+	**-**

You perform antibody panel, here are your 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	**2+**	**3+**
2	R_1R_1	0	+	0	+	0	+	+	0	+	0	3+	0	0	+	0	+	0	+	0	+	0	**2+**	**3+**
3	R_2R_2	0	0	+	+	+	0	+	0	+	+	3+	0	+	+	+	0	+	0	+	+	+	**3+**	**4+**
4	r'r	0	+	+	0	0	+	0	+	0	+	4+	0	0	+	0	0	+	+	0	0	+	**0**	**0**
5	r''r	0	0	+	0	+	+	0	+	+	+	0	0	0	+	0	0	0	+	+	0	+	**1+**	**4+**
6	rr	0	0	+	0	0	+	+	+	+	0	4+	0	+	+	0	0	0	0	+	+	0	**0**	**0**
7	rr	0	0	+	0	0	+	0	+	0	+	2+	0	0	+	0	0	0	+	+	0	+	**0**	**0**
8	rr	0	0	+	0	0	+	+	0	+	+	3+	0	0	+	0	0	+	+	+	0	+	**0**	**0**
9	rr	0	0	+	0	0	+	0	+	0	+	0	+	0	+	0	0	+	0	+	0	+	**1+**	**0**
10	rr	0	0	+	0	0	+	+	+	0	+	3+	0	+	0	+	+	0	+	+	+	0	**0**	**0**
Auto	rr	/	0	+	0	0	+	/	/	/	/	/	/	0	/	/	/	/	/	/	/	/	**0**	**0**

a. Critically evaluate all the results provided. Identify any antibody(s) present are there any that cannot be excluded? Explain your answer. (20 marks)

b. Outline what further testing you should undertake at this time and what follow up would you advise? (10 marks)

c. Discuss, in detail, the mechanism by which the antibodies identified can have a detrimental effect on the fetus. (20 marks)

d. What systems and treatment options are in place to prevent harm to the fetus? (20 marks)

e. Describe what red cells you would provide for this patient if she required blood during or after her pregnancy, explaining your rationale. (15 marks)

f. If the fetus requires transfusion support in-utero or as infant postnatally, what blood components would you provide and explain why? (15 marks)

3.
A female patient, aged 62, attends your hospital for "revision of total hip" orthopaedic surgery. She has a transfusion history from 18 years ago, which states that she is A D Positive with no clinically significant antibodies. She had also received 2 units of red cells, following major surgery. The clinical team have requested four units of red cells, to cover her surgical procedure, later that afternoon.

The current blood group, antibody screen and antibody identification panel results are shown below.

Blood Group

Anti-A	Anti-B	Anti-D1	Anti-D2	Control	A1 cells	B cells
4+	0	2+	1+	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	$R_1{}^wR_1$	+	+	-	+	-	+	+	-	-	+	-	-	-	-	-	-	-	+	-	-	**+**	**2+**
II	R_2R_2	-	-	+	+	+	-	+	-	+	+	+	-	-	+	-	+	-	+	-	+	-	**3+**
III	rr	-	-	+	-	-	+	+	+	-	-	+	-	+	+	-	-	+	-	+	+	+	**3+**

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	**2+**	**0**
2	R_1R_1	0	+	0	+	0	+	+	0	+	0	3+	0	0	+	0	+	0	+	0	+	0	**4+**	**0**
3	R_2R_2	0	0	+	+	+	0	+	0	+	+	3+	0	+	+	0	0	+	0	+	0	+	**3+**	**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	+	**1+**	**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	+	**3+**	**0**
9	rr	0	0	+	0	0	+	0	+	0	+	0	+	0	+	0	+	0	0	+	0	+	**0**	**0**
10	rr	0	0	+	0	0	+	+	+	0	+	3+	0	+	0	+	+	0	+	+	+	0	**1+**	**0**
Auto	rr	/	0	+	0	0	+	/	/	/	/	/	/	0	/	/	/	/	/	/	/	/	**0**	**0**

a. Critically analyse the ALL of the results obtained. Positively identify any antibody(s) present, are there any that cannot be excluded? Explain your answer. (20 marks)

b. The analyser has been unable to determine the patient's blood group. Critically evaluate any factors that may have influenced the outcome and lead to the uninterpretable result? How will you confirm the patient's blood group? (15 marks)

c. Describe, in detail, any further testing that should be performed to confirm the presence of the antibodies you have identified. (15 marks)

d. The patients historical blood group was recorded as A D positive. Do you agree with this, if not, why not? Would you perform any confirmatory tests to challenge this result? (20 marks)

e. You have been informed that the patient has a low pre-op haemoglobin and requires two units of red cells as soon as possible. Explain the steps you will take to provide compatible red cells to this patient. (20 marks)

f. Critically evaluate the importance of a patient's historical blood group in a computer system. Did this historical record aid with the blood group confirmation? How would you update the patient's transfusion record? (10 marks)