Higher Specialist Diploma

Haematology

Examination - September 2022

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 question on a new page

4. Each question is worth 25 marks

1. You have been asked to establish a sample acceptance policy for coagulation samples in your department. Briefly describe your policy and justify your decisions.

2. A 21-year-old female presents to A&E with unwell. Over the following days she has a number of full blood counts performed with the results outlined below.

Parameter	Reference Range	17.04.2022	18.04.2022	19.04.2022	20.04.2022
Hb	(115-165 g / L)	126	94	97	96
WBC	(4.0-11.0 $x10^9$ / L)	8.7	4.7	4.3	4.4
PLT	(150-450$x10^9$ / L)	99	93	91	90
RBC	(3.80-5.50$x10^{12}$ / L)	3.93	2.86	2.89	2.93
HCT	(0.37-0.48)	0.366	0.263	0.269	0.273
MCV	(80-100 fL)	93.1	91.8	92.9	93.2

Comment on the initial full blood count and outline the further actions you would take, if any. Briefly discuss the trend of the follow-up counts and outline further actions.

The sample dated 20.04.2022 has the clinical details hyperemesis; how would this impact the initial full blood count? And what treatment may have occurred to create the follow up results?

3. You are experiencing quality issues with the manual staining method used for staining blood films, bone marrow aspirates, and cytospins within your laboratory. Briefly discuss the initial actions you would take during your investigation of the problem. Following your investigation, you determine that you need to replace one of your stains. Outline the actions you would take and the considerations you would make.

4. Your laboratory participates in the Rapid Diagnostic Techniques for Malaria NEQAS scheme and over the last 18 months you have returned the following results. Review the results and briefly outline any abnormalities and the actions you would take.

Exercise	Reported Result	NEQAS result	Species
2102RD1	Negative	Positive	*P.falciparum* 0.75%
2102RD2	Negative	Negative	
2103RD1	Negative	Positive	*P.knowlesi* 7.5%
2103RD2	Negative	Positive	*P.falciparum* 3.1%
2104RD1	Negative	Negative	
2104RD2	Negative	Negative	
2201RD1	Negative	Negative	
2201RD2	Negative	Positive	*P.knowlesi* 2.1%
2202RD1	Positive	Negative	
2202RD2	Negative	Positive	*P.falciparum* 0.03%

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Essay Paper

120 minutes

Attempt 2 out of 5 questions

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

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3. Begin each new question on a new page

4. Each question is worth 100 marks

1. Critically discuss the use and limitations of screening tests in the haemostasis lab.

2. Critically discuss the D-Dimer assay and its use in the investigation of coagulation disorders.

3. Using appropriate examples, evaluate the significance of abnormalities in nuclear morphology and the association these abnormalities with named haematological disorders.

4. Evaluate the role of reticulocyte identification and enumeration in the elucidation of the causes of anaemia.

5. Critically discuss detection and quantification of HbF and the significance of differing levels of HbF in healthy subjects and those with haemoglobinopathies.

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Case studies

120 minutes

Attempt all case studies

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 case study on a new page

4. Each question is worth 100 marks

5. 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".

SEEN CASE STUDY

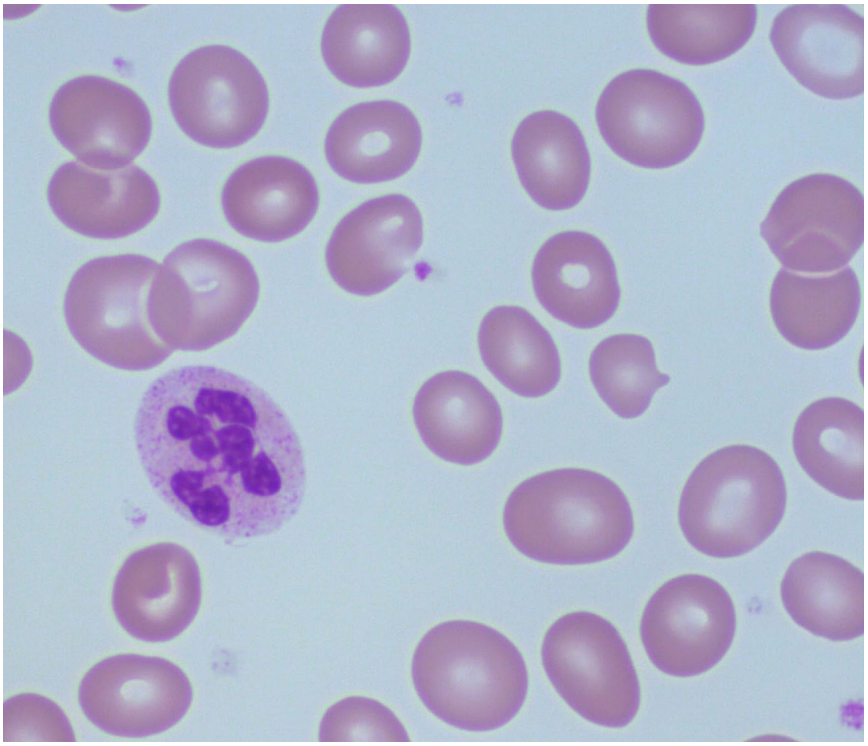
1.

A 58-year-old female patient was referred for a full blood count by her GP as part of an investigation for recurrent bacterial infection, gate ataxia, progressive weakness and paraesthesia of her upper and lower limbs. She had undergone gastric bypass surgery four years previously and had experienced rapid and sustained weight loss.

Parameter	Result	Reference range	Units
Red cell count	3.2	3.9 – 5.0	X 10^{12} / L
Haemoglobin	85	118 - 148	g / L
Mean Cell Volume	108	77 - 98	fL
Platelets	152	143 - 400	x 10^{9} / L
White Blood Cell Count	3.38	4.0 - 10.0	x 10^{9} / L
Neutrophils	1.8	2.0 - 7.0	x 10^{9} / L
Lymphocytes	1.1	1.0 - 3.0	x 10^{9} / L
Monocytes	0.4	0.2 - 1.0	x 10^{9} / L
Eosinophils	0.05	0.02 - 0.5	x 10^{9} / L
Basophils	0.03	0.02 - 0.1	x 10^{9} / L

a. Examine the patient's Full Blood Count results and identify the abnormal features. Indicate possible causes of these red cell findings. Justify your answer. (10 marks)

Based upon these results, a blood smear was produced and evaluated. An image from this smear is shown below.



b. Identify the white cell feature shown above and identify the range of conditions this feature is associated with. (10 marks)

Given the clinical and laboratory findings, haematinics were investigated. The results of these investigations are shown below.

Parameter	Result	Reference range	Units
B12	165	160 – 925	ng / L
Folate	15	>7	nmol / L
Ferritin	243	28 - 365	µg / L

Despite these findings, the GP decided to prescribe a course of IM injections of hydroxocobalamin over a four-month period. The patient was administered 1 mg three times a week for two weeks, then 1 mg every two months. After four months, the patient's condition had not improved. Her repeat FBC results are shown below:

Parameter	Result	Reference range	Units
Red cell count	2.9	3.9 – 5.0	X 10^{12} / L
Haemoglobin	78	118 - 148	G / L
Mean Cell Volume	104	77 - 98	fL
Platelets	157	143 - 400	x 10^{9} / L
White Blood Cell Count	2.52	4.0 - 10.0	x 10^{9} / L
Neutrophils	0.7	2.0 - 7.0	x 10^{9} / L
Lymphocytes	1.2	1.0 - 3.0	x 10^{9} / L
Monocytes	0.5	0.2 - 1.0	x 10^{9} / L
Eosinophils	0.08	0.02 - 0.5	x 10^{9} / L
Basophils	0.04	0.02 - 0.1	x 10^{9} / L

c. Compare the results from the initial and current FBC investigations. What do these results indicate and justify why IM hydroxocobalamin was administered? (10 marks)

Due to her declining results, and the refractory nature of her condition, it was decided that a bone marrow investigation would be conducted. This revealed the following:

Bone marrow aspirate	Left-shifted granulocytic maturation was noted with 4%–6% blasts. Morphologically, blasts appeared myeloid. Auer rods were not present. Features of dysgranulopoiesis included asynchronous maturation. Many of the early granulocytic precursors contained multiple small cytoplasmic vacuoles. The erythroid lineage demonstrated left-shifted maturation with many cells containing numerous cytoplasmic vacuoles. There were mild megaloblastoid changes and dyserythropoietic changes including nuclear irregularities, nuclear lobulation, and nuclear fragmentation. Perls' stain: revealed slightly increased iron stores and 2% ring sideroblasts.
Bone marrow trephine	Trephine demonstrated a hypercellular marrow of 70% - 80% with all lineages represented. Megakaryocytes appeared normal and were adequate for cellularity.

d. Based upon the bone marrow investigations, propose the most likely diagnoses. Are genetic atypia associated with any of the likely causes? If so, please describe the most commonly associated genetic findings. (30 marks)

The results of genetic analysis were all normal and the following karyotype: 46, XX was reported. Consequently, the patient was referred to a multidisciplinary team meeting. As the patient had previously undergone bariatric surgery, it was proposed the patient should undergo extended biochemical investigations to exclude nutritional deficiency as a cause of the symptoms. An excerpt of these results is shown below:

Parameter	Result	Reference range	Units
Calcium	2.61	2.2 – 2.63	Mmol / L
Iron	7	11-38	µmol / L
Copper	8	12 - 25	µmol / L
Caeruloplasmin	19	16 – 45	g / L
B12	220	160 – 925	ng / L
Folate	17	>7	nmol / L
Zinc	9	11 - 19	µmol /L
Vit D	16	>25	nmol / L
CRP	25	<5	mg / L

e. Please interpret these results. (10 marks)

f. Is there anything in these additional tests that would require you to re-evaluate your diagnosis and what actions could be taken to demonstrate the definitive diagnosis. (10 marks)

g. Provide a brief overview of the pathogenesis of this condition. (20 marks)

UNSEEN CASE STUDIES

2.

A set of blood samples arrive in the laboratory with a request for a full blood count and clotting screen. No clinical details are provided. Results are given below.

Initial Full Blood Count Investigations

Full Blood count		
	Result	Reference range
Red cell count ($x10^{12}$ / L)	4.5	4.3-5.7
Haemoglobin (g / L)	140	133-167
Mean Cell Volume (fL)	90	77-98
Mean Cell Haemoglobin (pg)	35	28-40
Platelets ($x10^9$ / L)	250	143-400
White Blood Cell count ($x10^9$ / L)	7.3	4.0-10.0
Neutrophils ($x10^9$ / L)	4.3	2.0-7.0
Lymphocytes ($x10^9$ / L)	2.8	1.0-3.0

Haemostasis Investigations

Haemostasis		
	Result	Reference range
Prothrombin Time (s)	18.0s	11-14s
Activated partial Thromboplastin Time (s)	45.0	24-34 s
Fibrinogen (g / l)	2.0	1.5-4.0

a. Describe the findings of this initial set of results. What possible causes could account for these results? (15 marks)

b. Based on these results alone, what further tests would you recommend – justify your choices. (15 marks)

c. The fibrinogen result is from a PT-derived method, as your lab manager has decided that this result should be reported for each patient. Is this a satisfactory approach? Justify your decision. (10 marks)

d. A Clauss fibrinogen assay give a result of 0.6g/l. How does this result affect your suggested diagnosis? (10 marks)

e. Further tests were performed – comment on the utility or contribution of these tests, and for each set of findings (A and B) suggest possible causes for this patients results.
(30 marks)

Test / assay	Reference range	A	B
Thrombin time	12-16s	60s	16s
Reptilase	14-18s	45s	18s
Fibrinogen antigen	2.0-4.0g / l	2.4g / l	0.8g / l
D-Dimer	<500ng / ml FEU	500 ng / ml FEU	500 ng / ml FEU
DRVVT	Ratio <1.2	Ratio 1.1	Ratio 2.2

f. For each set of findings, describe how you would clarify the cause of the abnormal results. What clinical information might be associated with each of these conditions?
(20 marks)

3.
Upon return from a 4-month trip abroad, an 8-year-old boy presents with increasing tiredness and lethargy, which his parents say is similar to cousins on both sides of the family. On examination he appears well: there is no fever. A blood sample was obtained and was sent for a full blood count and ESR. Results are as follows.

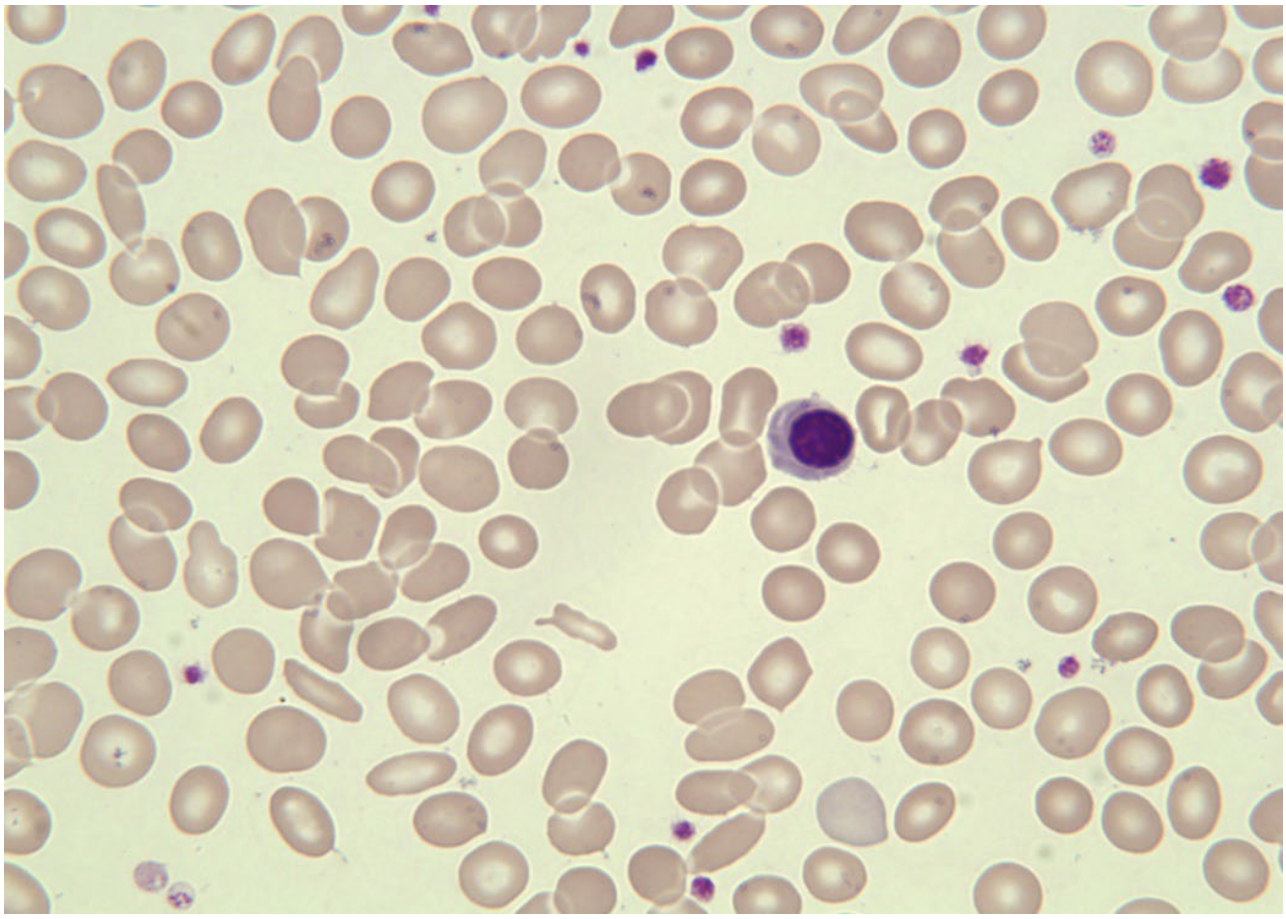
Analyte	**Result (units)**	**Reference range**
Haemoglobin	123 g / L	133 – 167
Red blood cell count	5.5 x 10^{12} / L	4.3 – 5.7
Haematocrit	0.42	0.35 – 0.53
MCV	76 fL	77 - 98
MCH	22.4 pg	26 – 33
MCHC	293 pg / L	330 – 370
ESR	8 mm / first hour	<10
RDW	14.8 %	10.3 -15.3
Reticulocytes	135 x 10^{9} / L	25 – 125
White blood cell count	7.6 x 10^{9} / L	4 – 10
Platelets	325 x 10^{9} / L	150 - 400

a. Describe the abnormalities. (5 marks)

b. Based on these results alone, propose and justify an initial diagnosis. (5 marks)

c. List potential causes of your diagnosis. (5 marks)

A representative field from a Romanowsky stained blood film is shown below:



d. Describe the abnormalities in the blood film and their implications for red cell biology. (20 marks)

e. In view of the results of the blood film, refine your preliminary diagnosis, giving your reasoning. (35 marks)

f. Justify which additional tests are required to confirm a diagnosis and use these to propose final potential diagnoses. (30 marks)