TEST	FUNCTION	UNITS	INCREASED	DECREASED
Hb *Haemoglobin*	Oxygen carrying component of blood	g/dL	• Dehydration • Chronic obstructive lung disease • Smoking • Heart failure • Renal cancer • Haematological malignancy	• Blood loss • After anticancer drugs eg chemotherapy & PARP inhibitors, due to bone marrow depression • Iron, folate and vitamin B12 deficiency • Chronic illness • Haemolysis • Chronic kidney disease • Haematological malignancy
Platelets (Thrombocytes)	Vital for blood coagulation.	10^9/L	**Thrombocythaemia** • Acute blood loss • Chronic illness • Certain forms of anaemia • Infection • Poor spleen function	**Thrombocytopenia** • Infections • Drugs – e.g. cytostatics • Radiotherapy (rare) • Immunologic disorders • Haematological malignancy • Cancer infiltrating bone marrow
WBC *White Blood Cells / Leukocytes* *Differential:* — *Basophils* — *Eosinophils* — *Neutrophils* — *Lymphocytes* — *Monocytes*	Protect the body against invading micro-organisms. The relative percentage of the various cells found in the blood is known as the (white cell) differential count.	10^9/L	• Infections • Haematological malignancies • Other cancers • Therapy with corticosteroids • Metabolic illnesses • Recovering bone marrow	• Drug – e.g. cytostatics • Radiotherapy (rare) • Haematological malignancy • Cancer infiltrating bone marrow • Immune disorders • Severe infections
ESR *Erythrocyte Sedimentation Rate*	Non-specific indication of inflammation	mm/H	• Focus or cause of inflammation • Infection • Connective tissue disorder • Rheumatoid arthritis • Pregnancy	• Immune disorders • Congestive heart failure
Red Cell Count (Erythrocyte Count)	Delivering Oxygen to the body tissues via the circulatory system	10^{12}/L	• Erythrocytosis • Polycythaemias • Smoking • Renal cancer • Haematological malignancy	• Anaemia(s) • Haemolysis • Microangiopathies • Bone marrow failure • Haematological malignancy • Chronic kidney disease

TEST	FUNCTION	UNITS	INCREASED	DECREASED
Bilirubin	Produced during metabolism of haem, and important part of haemoglobin. Produced and excreted by the liver. Enhanced production or diminished excretion leads to an accumulation of bilirubin causing jaundice.	µmol/L	• Jaundice / Biliary obstruction • Haemolysis • Advanced liver cirrhosis • Acute viral hepatitis • Inherited disorders or bilirubin metabolism	
Calcium	Vital role in body's electrical processes e.g. muscle contraction, heart beat and nerve conduction. Important in bone formation and blood coagulation.	mmol/L	Hypercalcaemia • Bone metastases • Multiple myeloma • Hyperparathyroidism • Certain drugs – e.g. diuretics • Renal failure • Sarcoid reactions	Hypocalcaemia • Hypoparathyroidism • Lack of vitamin D • Malabsorption • Renal insufficiency • Renal wasting -cytotoxic drugs e.g. cisplatin • Tumour lysis syndrome
Chloride	Changes in chloride content indicate changes in other electrolytes in the body	mmol/L	Hyperchloraemia • Hyperventilation • Dehydration	Hypochloraemia • Vomiting and diarrhoea • Metastatic alkalosis – secondary to low sodium
Creatinine	Principle parameter used for determination of renal function	µmol/L	• Renal failure of all causes	• If very low weight, muscle bulk
Glucose	The main energy source for the body.	mmol/L	Hyperglycaemia • Diabetes mellitus • Severe stress • Steroids	Hypoglycaemia • Insulin overdose • Insulinoma • Liver failure • Adrenal insufficiency • Severe sepsis
LDH *(lactate dehydrogenase)*	Present in all organs. Is a non-specific measurement of tissue breakdown and injury. It can be used to monitor certain malignancies such as Hodgkin's disease.	IU/L	• Hodgkin's Lymphoma • Liver disease • Haemolysis • Muscle disease • Myocardial infarction • Pancreatitis • Encephalitis and Meningitis	
Phosphorus	Major component of mineral phase of the bone. Involved in almost all metabolic processes.	mmol/L	Hyperphosphataemia • Renal failure • Hypoparathyroidism • Acromegaly • Tumour lysis syndromes	Hypophosphataemia • Hyperparathyroidism • Hypomagnesaemia • Alcoholism

TEST	FUNCTION	UNITS	INCREASED	DECREASED
Potassium	Important role in a number of metabolic processes.	mmol/L	Hyperkalaemia • Renal insufficiency • Potassium sparing diuretics and other drugs • Tissue damage • Addison's disease • Metabolic acidosis	Hypokalaemia • Excessive potassium loss – e.g. excessive vomiting or diarrhoea • Diuretics • Certain chemotherapeutic agents – e.g. antibiotics
Sodium	Most prevalent electrolyte in the plasma. Sodium metabolism is very closely interrelated with water metabolism.	mmol/L	Hypernatraemia • Impaired water intake • Excessive water loss – e.g. sweating, loss by the kidneys (diabetes insipidus and diabetes mellitus) or gastrointestinal loss (vomiting, diarrhoea)	Hyponatraemia • Cancer • Infection • Head injury • SIADH – syndrome of inappropriate ADH secretion - seen with drugs such as cyclophosphamide and vincristine • Ectopic ADH secretion in small cell lung cancer (SCLC) • Vomiting, diarrhoea • Advanced heart failure • Use of diuretics • Antibiotics and other drugs
Urate	Product of DNA metabolism and can be grossly elevated after massive cell death caused by cytotoxic drugs. Excreted by the kidneys. Deposition in the joints causes gout.	Mmol/L	• Following chemotherapy (when no preventative measures have been taken) • Tumour lysis syndrome • Renal insufficiency	Hyperthyroidism Myeloma
Urea	End product of metabolism of proteins in the body. Excreted by the kidneys and together with Creatinine is a measure of renal function.	Mmol/L	• Renal disease • Dehydration causing renal insufficiency	• Ectopic ADH secretion in small cell lung cancer (SCLC)

LABORATORY TESTS — LFTs (LIVER FUNCTION TESTS)

TEST	FUNCTION	UNITS	INCREASED	DECREASED
ALP *(alkaline phosphatase)*	Intracellular enzyme – hydrolyses synthetic phosphate esters. Produced by many tissues – especially bone, intestine, liver and placenta. Is excreted in bile.	IU/L	• Obstruction of the common bile duct • Liver disease • Increased osteoblast activity (may be a result of osteoblastic bone metastases or normal growth)	• Malnutrition
ALT *(alanine aminotransferase)*	Present primarily in the liver, to the lesser extent in the kidneys and skeletal muscle.	IU/L	• Liver cell damage – e.g. metastases	
AST *(aspartate aminotransferase)*	Present in all body tissues especially heart, liver and skeletal muscle. Released into the blood in excessive amount when these are damaged.	IU/L	• Liver cell damage – e.g. metastases • Myocardial infarction	
GGT *(Gamma-glutamyl transpeptidase)*	Present in many tissues. Involved in transfer of amino acids into cells. Measure of hepatobiliary disease	IU/L	• Liver metastases • All hepatobiliary disorders • Alcohol abuse	

NB. ALT /ALT both raised = transaminitis, Hepatic injury of any cause eg

- Infections
- Drugs
- Metastases

LABORATORY TESTS — CARDIAC TESTS

TEST	FUNCTION	UNITS	INCREASED	DECREASED
LVEF Left Ventricular Ejection Fraction	Cardiac function Potential damage from use of Herceptin and Anthracyclines (eg Doxorubicin)	%	• Good Function	• Poor Function

LABORATORY TESTS — PULMONARY FUNCTION TESTS (PFTs)

TEST	FUNCTION	UNITS	INCREASED	DECREASED
DLCO	Diffusion Capacity Measure of how easily oxygen passes from lungs into blood	mL/mmHg/min	• Lung haemorrhage	• Indicates a diffusion disorder such as Pulmonary Fibrosis • Chronic obstructive pulmonary disease
TLCO	Diffusion Capacity (This value can be considered the same as DLCO)	mL/mmHg/min		
FEV1/FVC ratio (FEV1%)	Spirometry. This test is a measure of volume and capacity of exhaled air. This is given as a true value (e.g. 99.00) and a %. As this is a ratio of a true value as a % of average the % can be > 100	% of normal	Increased in obstructive lung disease • Chronic obstructive pulmonary disease • Asthma	Decreased in restrictive lung disease • Pulmonary fibrosis
FEV1	Spirometry. Measure of exhalation volume in 1 second. This is given as a true value (e.g. 9.00) and a % of normal. As the true value can be above average the % can be > 100	% of normal		• Chronic obstructive pulmonary disease • Asthma

LABORATORY TESTS — THYROID FUNCTION TESTS

TEST	FUNCTION	UNITS	INCREASED	DECREASED
T4 *Thyroxine*	Hormone secreted by the Thyroid. It regulates the rate of metabolic processes in the body and influences physical development	mmol/L	Hyperthyroidism • Autoimmune • Thyroid adenoma • Thyroiditis • Teratoma • Pituitary adenoma	Hypothyroidism • Autoimmune • Iodine deficiency • Pituitary failure • Drugs
TSH *Thyroid Stimulating Hormone*	Regulates the endocrine function of the Thyroid gland	mU/L	Hypothyroidism	Hyperthyroidism

GONAD FUNCTION TESTS

TEST	FUNCTION	UNITS	INCREASED	DECREASED
FSH *Follicle Stimulating Hormone*	Hormone in the endocrine system. FSH regulates the development, growth, pubertal maturation, and reproductive processes of the body - (acts synergistically with LH)	IU/L	• Post-menopause • Pituitary tumour	• Pregnancy • Rapid weight loss • Pituitary failure
LH *Luteinizing Hormone* **ICSH** *(interstitial cell-stimulating hormone)*	In females this hormone triggers ovulation and in men produces testosterone	mIU/mL	• Post-menopause • Polycystic ovarian syndrome	• Pituitary failure
Oestradiol	Sex hormone found in both sexes. Regulates female organ and tissue development. In males it regulates the life cycle of sperm cells. Also has effects on bone structure, protein synthesis in the liver, neuroprotective function in the brain, blood flow in blood vessels, and oncogene activation in breast and endometrial cancers	ng/dL	• Liver cirrhosis • Adrenal cancer • Testicular tumour	• Ovarian failure • Post-menopause • Polycystic ovarian syndrome • Pituitary failure
Testosterone	Male reproductive organ and tissue development, muscle development, bone mass and body hair	ng/dL	• Testicular tumour • Ovarian cancer	• Hypopituitarism
Sperm Count	Concentration of sperm	10^6/mL		

LABORATORY TESTS — LIPID PROFILE

TEST	FUNCTION	UNITS	INCREASED	DECREASED
Total Cholesterol	• Membrane production	mmol/L or mg/dL	Hypercholesterolaemia • Kidney disease • Diabetes • Alcohol • Overweight	Hypocholesterolaemia
Triglycerides	• An ester containing glycerol and fatty acids	mmol/L or mg/dL	• Cardiovascular Disease	
HDL –C - *High-density lipoprotein cholesterol*	• Lipid transportation (known as good cholesterol)	mmol/L or mg/dL		
LDL-C - *Low-density lipoprotein cholesterol*	• Lipid transportation (known as bad cholesterol)	mmol/L or mg/dL	Hypercholesterolaemia • Kidney disease • Diabetes • Alcohol • Overweight	

LABORATORY TESTS — CREATINE PHOSPHOKINASE

TEST	FUNCTION	UNITS	INCREASED	DECREASED
Creatine Phosphokinase	An enzyme that is present in various tissues and cell types (e.g. skeletal and heart muscle). Damage to these tissues and cells releases this enzyme so that it becomes detectable in the blood. This enzyme is thus a marker for certain types of tissue/cell damage.	U/L	• Stroke • Inflammatory muscle disorders • Heart attack • Rhabdomyolysis	

TEST	FUNCTION	UNITS	INCREASED	DECREASED
Serum IgA *Ig = Imunnoglobulin*	• Antibody that forms immunity of the mucosa	g/L	• Myeloma • Infection	• Immunodeficiency • Gonorrhoea
IgM	• Primary antibody against A and B antigens on red blood cells	g/L	• Liver disease • Infection • Myeloma	• Hereditary • Myeloma
IgD	• Main role in the signalling pathway for B-cell activation	g/L	• Infection • Myeloma	• Immunodeficiency
IgG	• Antibody of secondary immune response	g/L	• Infection • Myeloma	• Immunodeficiency
IgE	• Antibody associated with allergy and immune response to parasites	g/L	• Allergy • Asthma • Myeloma (rare)	• Immunodeficiency
Kappa Serum Free Light Chain *(3.30 – 19.40)*	• Polypeptide subunit of an B Lymphocyte (antibody) that binds with an antigen	mg/L	• Myeloma	
Lambda Serum Free Light Chain *(5.71 – 26.30)*	• Polypeptide subunit of an B Lymphocyte (antibody) that binds with an antigen	mg/L	• Myeloma	
Kappa to Lambda Ratio *(Serum ratio = 2:1* *Free Light Chain ratio = 1:1.5)* *Or as decimal 0.26 – 1.65)*	• B Lymphocytes express only one type of light chain. This ratio is an indication of clonal disease	Ratio or decimal	• Neoplasm • Inflammatory condition (proliferation of polyclonal FLCs) • Biclonal gammopathies of different FLC types	• Bone marrow function impairment
Serum Paraprotein	• Abnormal immunoglobulin (Ig) or light chain secreted in excess by plasma cells (white blood cell type) during myeloma (myeloma is a plasma cell cancer)	g/L	• Myeloma	

LABORATORY TESTS

TUMOUR MARKERS (useful in staging disease as wells as monitoring response to treatment)

TEST	FUNCTION	INCREASED
AFP *(alpha-fetoprotein)*	Synthesised by the liver, yolk sac and GI tract of the human foetus. Reaches peak plasma concentration at 12 – 15 weeks gestation, decreasing to normal adult levels 6 – 12 months after birth. AFP has prognostic implication. During therapy the rate of decline predicts the effectiveness of therapy. Rising level is direct evidence of tumour progression.	**CANCER RELATED** • Embryonal and teratocarcinomas of the ovary and testes • Extragonadal germ cell tumours • Hepatoma and other liver diseases • Cancer of pancreas, stomach, colon and lung (less frequent) **OTHER REASONS** • Ataxia telangiectasia
CA125 *(carbohydrate antigen 125)*	Monoclonal antibody which recognises a certain antigen and is used as a marker for patients with ovarian cancer. A persistently elevated CA125 following oophorectomy for suspected stage I ovarian carcinoma is definite evidence of residual disease.	**CANCER RELATED** • Ovarian cancer • Advanced intra-abdominal (non-ovarian) malignancy • Ascitic fluid – due to cancer (or other disease) **OTHER REASONS** • First trimester of pregnancy • Endometriosis • Cirrhosis • Health controls
CEA *(carcinoembryonic antigen)*	Normally secreted during the second to sixth month of gestation. In non-smoking adults serum levels are 2.5ng/ml, smokers have normal levels up to 5ng/ml. Principle role of this marker is to monitor the response to treatment. A complete response to surgery, radiotherapy or chemotherapy should bring an elevated CEA to normal within one month of treatment. A persistent or increasing elevation is highly suggestive of residual or recurrent tumour.	**CANCER RELATED** • Colon cancer • Pancreatic cancer • Gastric cancer • Lung cancer • Breast cancer **OTHER REASONS** • Inflammatory bowel disease
CT *(calcitonin)*	Normally secreted by the parafollicular cells of the thyroid gland and serves as an excellent marker of tumours developed from these cells (medullary carcinomas). Calcitonin is also secreted by a variety of other tumours.	**CANCER RELATED** • Medullary thyroid cancer • Disseminated breast cancer • Lung cancer
ER and PgR *(estradiol & progesterone receptor)*	The presence of ER and/or PgR receptor activity in breast tumour tissue is an indicator of its hormone dependency. Both markers are now frequently used in clinical practice to select, to each patient individually, the most appropriate form of systemic adjuvant or palliative therapy. The presence of ER and PgR is an important prognostic factor that is correlated with a better clinical outcome.	**CANCER RELATED** • Breast cancer

TUMOUR MARKERS continued (useful in staging disease as wells as monitoring response to treatment)

TEST	FUNCTION	INCREASED
hCG *(human chorionic gonadotrophin)*	Hormone secreted by the placenta and consisting of α and β subunits. The β subunits is normally present in maternal serum during pregnancy, however, presence in non-pregnant females and males is indicative of cancer. Its level has prognostic importance and a decrease marks an effect of therapy.	**CANCER RELATED** • Trophoblastic tumours (Choriocarcinoma, hydatidiform mole) • Germ cell tumour of the testes **OTHER REASONS** • Pregnancy
PAP *(prostatic acid phosphatise)*	Enzyme produced by the prostatic epithelium. Less sensitive and specific than PSA levels with regards to prostatic cancer.	**CANCER RELATED** • Prostate cancer **OTHER REASONS** • Benign prostatic hypertrophy
PSA *(prostate-specific antigen)*	Secreted exclusively by prostatic epithelial cells. Its serum concentration increased in men with prostatic disease.	**CANCER RELATED** • Prostate cancer **OTHER REASONS** • Benign prostatic hypertrophy
Tg *(thyroglobulin)*	Increased in patients with thyroid disease. Increased Tg in patients with metastatic carcinoma of the thyroid is an indication of tumour tissue being present in the body.	**CANCER RELATED** • Thyroid cancer **OTHER REASONS** • Hyperthyroidism • Dysplastic struma