acids, enzymes and hormones. Inorganic substances consists of 0.9 to 1% of blood plasma, they are found as salts of calcium, potassium and sodium also the metabolic products found in plasma are in form of urea and uric acid (Table 2.3).

Main function of plasma is :

1. Carrying metabolic and carbondioxide from tissues
2. Protective through antibody found in plasma

Main function of blood are as follows :

1. Metabolic—carriage of nutrition to tissue and bring back the waste products from tissue for excreation.
2. Protective function is exerted through antibody and phagocytosis.
3. Hormonal regulation by transporting hormone to different parts of body.
4. Temperature regulation by dissipitating temperature from hotter to cool area.
5. Respiratory function by carrying oxygen to tissues and bring back carbon dioxide from tissue to lungs.

Property of blood

Physically blood is red coloured viscid fluid containing R.B.C., W.B.C., platelet and plasma, the oxyhaemoglobin in suspension is responsible for its scarlet red colour whereas less oxygenated venous blood is dark red. The opacity of blood is due to different refractive power possessed by the RBCs and plasma. Blood becomes transparent when RBCs are haemolysed and cannot reflect light. The other physical property of blood includes colloid osmotic pressure, colloid stability, property of sedimentation, viscosity, specific gravity, surface tension, absorption of radiation, rotation of polarised light and light scattering.

Osmotic pressure of blood is being maintained largely by kidney. This value for whole blood corresponds to an osmotic pressure of 7.9 atmosphere at body temperature. The solutions having equal osmotic pressure as that of blood is called isosmotic viz. 0.9% sodium chloride solution, osmotic effect of blood is due to dissolved electrolytes, responsible for crystalloid osmotic pressure and plasma protein responsible for colloid osmotic pressure. Vascular membranes are not permeable to proteins. Direction of flow of fluid as such will be from low hydrostatic pressure to that of high osmotic pressure of plasma at venous end and vice versa. This results in equal osmolality in both sides of membrane separating the compartment.

Table 2.3. Composition of plasma

Diffusable	Non-diffusable
1. Anabolic-glucose, amino acid creatine	1. Protein - Albumin, Globulin, Fibrinogen
2. Catabolic - urea, uric acid and creatinine	2. Lipid
3. Electrolytes - Na^+, K^+, Ca^{++}, Mg^{++}, Cl^-, HCO_3, HPO_4, H_2PO_4	3. Enzyme
4. Hormones and vitamins	4. Antibody

stainless steel four in number for four groups of blood and divided in middle to accommodate positive and negative group.

10. **Deep freezer :** Maintains temperature between –30°C to –70°C, mainly for deep freezing of plasma and products and other blood components.
11. **Platelet incubator :** Platelets are preserved at room temperaturei.e. +22°C and it has been further observed that platelets preserved at +22°C are more effective than the platelets storedat +4°C. Also at room temperature of +22°C platelets remain viable for five days maximum but up to 72 hours the viability is best maintained.

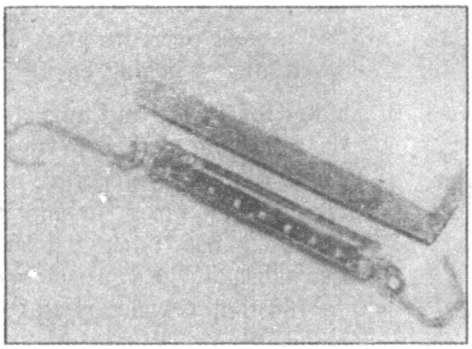

Fig. 2.12. Spring balance.

The incubators may be single/dual type, it holds platelet rotator and agitator. It has arrangement for air circulation with high density insulation to maintain uniform temperature. Temperature can be fixed at 22°C or kept variable as per range the minimum starts from +15°C. Alarm system included. Chart recorder for temperature recording. Interior to be made up of stainless steel. Audio-visual alarm system should include high low safety alarm system.

12. **Spring balance :** This is used for weighing the blood collected in the bag from the donor so that we know the exact amount that is collected and stop the bleeding of donor after actual collection. The blood bag is hangedwith the hook of the spring balance. Each ml of blood approximately weighs 1.05 gm so 350 ml will measure 367 gm an amount of ± 10% is allowed (Fig. 2.12).
13. **Air incubator :** Some busy laboratory where large scale serological work is undertaken prefers air incubator to water bath to provide a temperature of 37°C. A hot room at 37°C has added advantage to accommodate bench, microscope and centrifuge etc.

Recommended for further reading

1. *Biochemistry of Blood in Health and Disease I, Newton Kuglemass, first edition, 1959, publisher, Charles C. Thomas, Bannerstone House, 301-327, East Lawrence Avenue, Springfield Illinois, USA.*
2. *Cardiovascular Physiology — By Robert M. Berme and Mathew N. Levey, third edition, 1977, C.V. Mosby and Company.*
3. *Cunnighams Manual of Practical Anatomy (Vol. 1), 12th edition, Oxford University Press, London.*
4. *Gray's Human Anatomy, 34th edition, 1967 by Dr. D.V. Davies, Univ. of London.*
5. *Introduction to Transfusion Medicine, Zarin S. Bharucha and D.M. Chouhan.*
6. *Human Anatomy and Physiology, V. Tatarinov, Fourth edition, 1978, Mir Publisher, Moscow.*
7. *National Guide Book on Blood Donor Motivation, First edition, 1990, Published by DGHS, MOH and F.W., New Delhi-110011.*
8. *Samson Wright's Applied Physiology, 12th edition, 1971, Revised by Cyril A. Keele and Eric Neill, ELBS and Oxford University Press.*
9. *An Introduction to Medical Genetics by J.A.F. Robert's and Marcous E. Pembrey, Seventh edition, 1978, ELBS and Oxford University Press.*
10. *Genetics in Medicine by J.S. Thompson and M.W. Thompson, Reprinted edition, Nov. 1970, W.B. Saunder's and Company, Philadelphia and London.*

(c) Those who has received antisera viz., ATS, gas gangrene sera or antidiphtheric sera should not donate at least for 4 weeks.

Drug therapy

Avoid donations from donors receiving anticonvulsant, anticoagulant, corticosteroid, hypotensive drug, analgesic, antipyretic, particular attention for those containing aspirin, antihistaminic etc. In case the donor is meant for blood from which platelets are to be processed reject any donor with history of ingesting aspirin during previous 72 hours or those who are habitual taker of aspirin or drugs containing aspirin. History of any other disease the donor is suffering from and donor is accordingly accepted or rejected. A summary of diseases are given in Table 3.3.

Special precautions to be taken and preferably do not collect any donation from patient suffering from cancer, bleeding disorder, blood cancer or donor exhibiting any immunodeficiency syndrome.

After all the formalities are observed and the attending doctor is satisfied and found the donor physical and other criterias as described in Table 3.3 are within normal limit or nothing against detected the donor is declared fit.

Next the donor is taken to the donation room or bleeding room, the room must be spacious enough to accommodate 5/6 or ten donors (area for bleeding room has already been given); fitted with airconditioner, ceiling fan, sufficient and adequate light and emergency drugs, oxygen cylinder etc., refrigerator for immediate storage of blood after collection. Comfortable examination table, B, P instrument and tourniquet, spirit swab. Bleeding room be checked up periodically by hospital infection committee and swab culture obtained from different places to detect any bacterial contamination, if gross contaminations is reported proper care for disinfection is taken.

Donor walks barefooted in the room and he is made to lie down on examination table in supine position he is made to feel comfortable on the bed and doctor allays his anxiety or fear of donation if he has any.

In some collection centre, donor chairs (manufactured by Baxter) are used where donors are made to seat for bleeding.

Site selection and body position

The selection of site for bleeding, technique of blood withdrawal and position of donor is of paramount importance for both the donor and phlebotomist.

Position of the donor/patient while withdrawal or administration of blood is important because procedure takes quite a long time so patient/donor must be placed in a comfortable position that doesnot interfere with the process rather helps for smooth operation and continuation of the process. Phlebotomist should also find it smooth for operation.

By experience it was found that supine position is the best position for both the donor/patient and the Phlebotomist. Further the gravitational effect is more pronounced when the body is in erect posture. Supine position when both limbs are at rest, veins/artery are easily accessible to the operator and wrapping round the cuff of B.P. instrument is easier. For all this facility available, both the upper limbs are usually selected for puncture of veins either to withdraw/administer the blood.

Veins are mainly preferred because :

1. They are placed superficially.
2. They have an unidirectional flow (Fig. 2.1, Chapter 2) of blood directing the blood towards the heart.

4. More resilient absorbs shocks and jerks and less liable to breakage
5. Chance of air embolism and/or bacterial contamination is almost nil
6. Disposable - no washing or sterilisation is necessary discarding through incinerator is easy
7. Component separation and preservation is better
8. Pressure infusion is possible
9. Collection of blood is easy for all the systems are inbuilt
10. Segments contain small amount of blood which can be used for pretransfusion tests.

These plastic bags are made of Polyvinyl chloride to which plasticizer Diethyl Hexyl phthalate (DEHP) is added to provide necessary clarity and flexibility to bags. It was later found that the esters of DEHP leaches out from the bag into the blood and thus it accumulates in tissue of recipients. At 4°C after the end of storage total phthalate level has been found to be about 7 mg/100 ml and which is well within the maximum permissible limit of 10 mg/100 ml of blood. But the research result showed that leached phthalate increase PTS. Even though no other ill effects were discovered the scientist tried to develop P.V.C. with less or no plasticizer and following bags were developed :

(a) CLX mark II contains DEHP and Tri (2 ethyl hexyl) trimalleate.

(b) F 702 contains triethyl hexyl Benzene tricarboxylate as plasticizer.

(c) PL-732 bag contains no plasticizer and are soft bags made up of polyolefine used extensively for preservation of RBC at frozen state at ultra low temperature and also for preservation of platelet.

(d) Ethylene Ethyl acrylate bag contains no plasticizer.

Apart from plastic bags which are the primary container secondary containers to hold the plastic bags in static or ambulatory position are also in use.

Metal containers made of aluminium are used to hold the bags in upright position in an atmosphere of ultralow temperature of –150°C to 196°C. The secondary container protects the bags from accidental cracking because bags become very brittle at such low temperature.

Secondary containers are also used during transport of bags individual unit or multiple units. For individual unit bags are kept in container made of disposable and thermocole material. This type of containers are used for short distance travel.

For multiple unit and long distance transport the ice boxes made of metal in which blood bags are placed amidst ice crystals are particularly used in outdoor donation camp where blood is temporarily preserved till donation is over and later transport to blood bank walk in cooler or blood bank refrigerator.

3.6 PROTOCOL FOR OUTDOOR DONATION CAMP

1. Fix a mutually convenient date with the organiser.
2. Choose the area suitable for conduction of outdoor donation camp - preferably in a school or community centre with facility for fan and water and resting place. If this is not available a tent with beds for at least six people, revolving stand fans and water tankers are to be made available at place of donation.