2. **Electric Charge.**

(a) Review II, B, as above.

(b) See also influence of hydrogen ion concentration on electric charge (Syn. IV).

ULTRAMICROSCOPY

GENERAL DIRECTIONS:

The dark field condenser (d.f.c.) is to be inserted into position. Inside stop is placed in the oil-immersion objective. Illumination is adjusted so that a hollow cone of light is obtained using uranium glass for guidance.

Place immersion oil on face of d.f.c. upper lens to fill space between this and slide.

A slide of proper thickness (ca I.5 m.m.) is placed on stage. A drop of fluid to be examined is placed in position. Cover with thin cover-slip.

Centre spot of light with l.p. objective.

Adjust I.9 m.m. obj.

At close of exercise remove inside stop from objective.

(A.) **Preliminary Practice** with physical materials.

Mount and examine suspensions provided, noticing Brownian movements, colour, definiteness of particles.

(B) **Studies of Biological Material.**

Ultramicroscopic examination of colloidal complexes.

Mount and examine squamous epithelial cells from the mouth, and note the bacterial flora accompanying them.

Milk. Cow's milk largely freed of butter fat.

(a) Observe character of casein suspensoids; amplitude of their Brownian movements, colour, brightness.

(b) Coagulation, add weak HCL.

(c) Coagulate a film on the slide with alcohol.

(d) Character of droplets (emulsoids) of butter fat (milk with more butter fat). Coagulation with HCL.

Compare their behaviour as compared with agglutinated erythrocytes.

Blood. Frog; mammal.

Observe especially the mutual behaviour of corpuscles, suspensoids, and the formation of fibrin threads.

Study the specific effect of saponin, and of ricin or abrin. Lymph, urine or other body fluids may also be examined, if time permits.

Bacterial suspensions.

Protoplasm. Spirogyra, onion or other suitable material.

SYNOPSIS IV

HYDROGEN ION CONCENTRATION.

LITERATURE: W. M. Clark: Determination of Hydrogen ions. Bayliss p. 187.

INDICATORS AND THEIR USE; BUFFER ACTION.

A. PHYSICO-CHEMICAL.

Super-clean glassware is an essential in all H-ion work.

H_2O in the following exercises always signifies boiled distilled water.

1. **Behaviour of Indicators.** (In this and the following exercises approximate titration may be done by drop measurements, checking, by c.c. measurements at end or critical points). To equal quantities of .1N NaOH in 4 separate tts. add two or three drops of phenolpthalein, neutral red, methyl orange and crystal violet respectively, and titrate simultaneously with .1N H Cl, added drop by drop from a pipette. After 10 c.c. or so have been added continue with strong (4 N) H Cl till no further change is observed.

Carefully record colours and colour changes in each case. Estimate in terms or normality of alkali or acid, the points at which the most distinct colour changes take place.

Which indicator and colour enable you to determine the neutral point (i.e. acid = alkali or, for comparison, pure H_2O).

2. **"Acidity" and H–ion Concentration.**

(a) **To determine the relation of the colour changes to acid concentration,** using different types of acid and eliminating alkali.

1. Make up a series of concentrations of HCl (a strong acid) viz., 2N, 1N, .1N .01N and .001N. To 10 c.c. of each, add a few drops of Crystal Violet. Note series of colours.

2. Repeat for one or two of same concs. with H_2SO_4, another strong acid. Do the indicator colours correspond ?

3. Do the same with 1N acetic acid (a weak acid). Result ?

4. Test a small measured quantity of 1N acetic acid with methyl orange noting