The test for protein theory/practical marking scheme

Students were given the following instructions, study and answer the questions.

(a) Label four test-tubes 1-4.

(b) Put about 5 mm (*depth*) of
- 1% starch solution into tube 1
- 10% glucose solution into tube 2
- 1% albumen solution into tube 3
- water into tube 4

(c) Pour into each tube, about 2 mm dilute sodium hydroxide carefully not spill on clothes or skin.

(d) Add to this about 2 mm dilute copper II sulphate solution. Shake the tube *sideways* to mix the contents by stroking the bottom of test tube repeatedly.

(e) Return the tubes to the rack, leave for a few seconds and record the resulting colours in table below. Predict the expected results. (8 marks)

Test tube	*Food substance*	*Reaction with copper II sulphate and sodium hydroxide*
1	1% starch solution	Blue colour of copper II sulphate persisted
2	10% glucose solution/reducing sugar	Blue colour of copper II sulphate persisted
3	1% albumen/protein	Purple colour appeared
4	water	Blue colour of copper II sulphate persisted

1 The substances selected for testing are examples of three of the principal types of chemical substances in cells; starch, sugar (glucose), protein (albumen).
With which of these samples did the reaction give a purple colour?
Only the albumen should give a purple colour.

2 The substance which gave a purple colour was a single example of its class of substances. Would you expect all other samples of this class to give the same reaction?

The students should not be prepared to make a generalization about all proteins from a single reaction with albumen solution.

If albumen is a typical protein, then it is proteins that will normally give the biuret reaction.
In fact it is given by all substances having at least two peptide linkages (-CO-NH-) which includes all proteins and most peptides.

3 What was the point of using test-tube 4 with the water?
It could be argued that sodium hydroxide and copper II sulphate will produce the characteristic purple colour whether or not proteins are present but the reaction is suppressed in the presence of glucose or starch.
The control with test-tube 4 makes this explanation less likely.

NOTE This test is called the 'biuret' test. 'Biuret' is the name of the compound which gives the purple colour.

The test for proteins - *preparation*

Outline The Biuret test is applied to starch, glucose and albumen solutions to show that only the protein gives a positive result.

Prior knowledge None, except perhaps that sodium hydroxide has caustic properties.

Advance preparation and materials*

1% starch solution
10% glucose solution } 5 cm^3 per group
1% albumen solution

sodium hydroxide 2N or 10%
1% copper sulphate solution } 10 cm^3 per group

(Dilute hydrochloric acid should be available to neutralize any caustic soda spilt.)

Apparatus-*per group*

test-tube rack and 4 test-tubes
4 labels or spirit marker