

in the United Kingdom. Candidates must pass to the satisfaction of the Civil Service Commissioners in all these subjects. When two or more candidates are nominated to compete for one vacancy the competition will be in subjects 5, 6, and 7. The limits of age will be 21 to 30, with an extension up to 38 in the case of a candidate who has been occupied as master, manager, foreman, or workman in a factory or workshop for at least seven years, and has acquired practical acquaintance with the working of factories and workshops. An official nomination by the Home Secretary is required for this situation.

Technical Education.

THE EXAMINATIONS OF THE CITY AND GUILDS OF LONDON INSTITUTE.

The following questions were set in the subjects named at the recent examinations held by the above Institute. The remainder of the textile questions will appear in our future issues:—

19A.—CLOTH MANUFACTURE.

SECTION II.—WOOL AND WORSTED WEAVING.

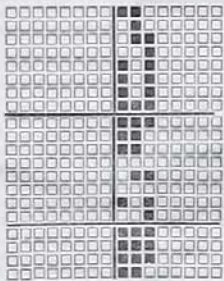
INSTRUCTIONS.

The candidate must confine himself to one grade only, the Ordinary or Honours, and must select his questions from those of Division I. or II. He must not answer questions in more than one grade or one division. If he has already passed in the first class of the Ordinary Grade, Weaving and Pattern Designing (former Programme), he must select his questions from those of the Honours Grade of this subject. Three pieces of material and a piece of point paper are supplied to each candidate. Four hours allowed for this paper. Not more than ten questions to be attempted. Candidates are requested to state the town in which they have been employed.

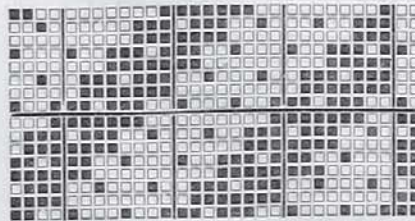
ORDINARY GRADE.

DIVISION I.

- Convert the following yarns into Yorkshire woollen skeins:—2/50's worsted, 15 cut gala, 2/80's cotton, 60/2 spun silk.
- Complete the diagonal of which the accompanying plan is the commencement.

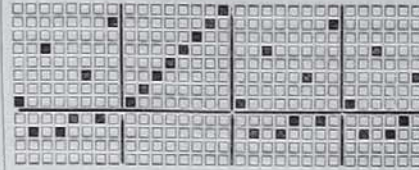


- Give a plan and particulars to weave an accompanying pattern.
- Make draft and pegging plan to weave the accompanying design on the least possible number of shafts.

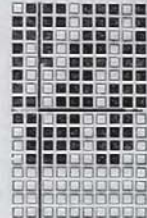


- Describe the witch or dobbie machine you are best acquainted with, single or double lift, either for hand or power loom.
- Give the difference between open and close shedding, and what are the advantages of either system?
- Give the thickness in woollen counts of a thread of 20 skeins woollen doubled with a 70/2 fold span silk; also give the cost of the twisted thread, the woollen yarn costing 2s. 6d., and the silk 15s. per lb.

- Find the number of healds per inch on each shaft in the following draft plan. 20 reed, 6 ends in a reed.



- Complete the design from the pegging plan, taking your draft plan from previous question.



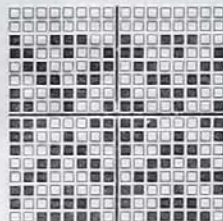
- A cloth woven with 50 picks of 30 skeins woollen yarn, how many picks should it have if you change it to 20 skeins, with the same plan and same weight on warp beam?

ORDINARY GRADE.

DIVISION II.

- Make a drawing of a sett of stocks and bowles for a 7-end twill.
- What pinion and intermediate wheels will be required on a loom to weave a 14 pick twill pattern, supposing you have 130 teeth in your tappet shaft wheel?
- Give draft showing the least possible number of healds design A can be woven on, and draw a tappet to form pattern of the first end of design

FIG. A.



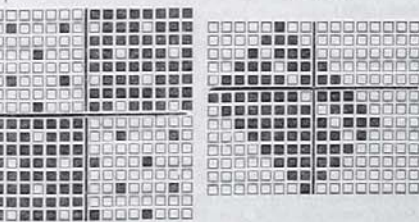
- Why should the healds have an eccentric motion imparted to them during weaving, and what would be the effect if it were not so; on what principle are tappets drawn to give that particular motion?

- What would be the resulting worsted counts, if two yarns, as follows, were twisted together: one thread of 80's, and one of 50's single worsted? also state what they would be equal to in cotton counts.

- Draw a section of a Jacquard machine, showing eight hooks, cylinder, needles, and spring box in position, and the mode of fastening the neckbands to the hooks (single lift).

- From Fig. B, construct a design in the order of a 5 end satin. Design to occupy 40 ends and 40 picks, and the ground space to be equal between each of the spots.

FIG. B.

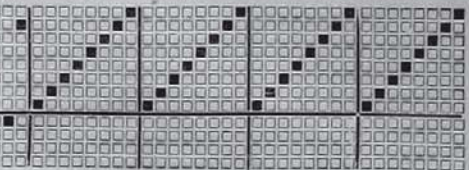


- If you have a cloth made with 80 ends per inch of 2-fold 40's worsted warp, 48 inches wide in reed; warp 70 yards long; and 72 picks per inch of 2 fold 80's worsted weft; piece to be 66 yards long out of loom—warp to cost 2s. 9d. per lb., and weft 3s. 1d. per lb.—give weight and price of each, separately.

- What are the advantages gained by sizing single twist warps, both in worsted and cotton, and state your opinion as to what you think the best

method of sizing same, and give reasons.

- State why in weaving some classes of plain goods the bottom warp, when the shed is open, is



- depressed more below the centre than the top warp is raised above. Give a drawing showing position of warp line when the shed is full open.

- Supposing you have a cloth made in a 56 sett (Bradford system) with 2-fold 40's worsted warp, having 64 picks per inch of 2/60's worsted weft, weight of cloth 16 ounces to the yard—What warp and weft, sett and picks will be required to make it 2 ounces heavier, and still retain the same character of cloth?

- Give draft and pegging plan for weaving gauze cloth, 2 ends crossing 2 ends, and say how it would be best to ease the crossing warp.

- Describe the difference between the dobbie and a Jacquard machine, and state the advantages, if any, that the one has over the other.

- Give a drawing of a weft fork and lever in position.

HONOURS GRADE.

DIVISION I.

- Given a Jacquard with a capacity of 384 hooks in a board of 3 inches, and you require to weave a design of 48 threads in a set of 96 threads per inch, how many will you have to cast out, and how would you distribute them?

- Give a plan and particulars to make the accompanying pattern.

- What length of cloth can you make from 10 lbs. of 2/20's worsted yarn, 9 reed, 4 in a reed, and 44 picks?

- What would be the average grist of yarn in a cloth made with two threads of 2 48's worsted, and one thread of 20 cuts gala counts?

- Make a plan from accompanying sketch to be composed of three different weaves, give the particulars for weaving and gristing, the whole pattern to be not more than 96 ends in extent.

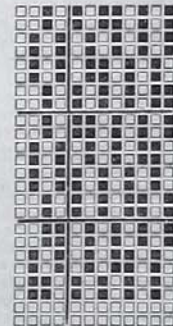
8 shaft Satin make.	Any weave that works well.	8 shaft Satin make.	Any weave that works well.	8 shaft satin make.
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- Describe a Kidder carpet Jacquard, or loom for weaving double plain designs.

- Calculate weight and cost per yard of following cloth:—60 ends per inch of 30 skeins warp at 2s. per lb.; 66 picks of 20 skeins weft at 1s. 6d. per lb.; 50 yards warp 70 in. wide in loom, 40 yards when finished, 10 per cent. waste, cost of production £3.

- (a) Work out a double cloth with a cut check pattern, give heading draft and all weaving particulars. (b) Also give plan for double cloth cassimere face and back, one thread face and one thread back, both warp and weft, tie the two fabrics together so as not to show stitching.

- Put a backing web to the accompanying plan two picks of face to one of backing; give the design on point paper.



- A cloth is required to be made with 40's cotton, the pattern an 8-end twill with four intersections; how many threads per inch will it require, the diameter of the thread being 1/32?

HONOURS GRADE.

DIVISION II.

- For what classes of goods are hand-loom preferable to power looms, and why? Describe the class of hand-loom most generally used.

36. What will be the resulting counts of the following yarns twisted together:—one thread of 80's, one of 60's, and one of 40's cotton; also, the following 2 threads 60/2 fold silk, and 1 of 2/60's cotton?

37. Draw a design on point paper of this Fig. arranged in the order of an 8-end satin, with a 2 and 2 will ground, the whole design to occupy 72 ends and 72 picks; and the ground to be equal between each of the spots.

38. Give drawing of and describe the uses of a pressure harness, and the class of goods for which they are used.

39. Analyse attached bit of cloth, and give the following particulars:—1st, the material of which it is made; 2nd, an estimate of the counts of yarn, both warp and weft; 3rd, say how it is finished to get the brightness so full on the cloth.

40. To make a warp 600 yards long you have 100 lbs. weight of material, and there must be 2 threads of 2/60's worsted yarn to 1 thread 2/40's worsted yarn; how many ends and what weight of each yarn will be required?

41. With following dimensions draw a tappet to weave pattern 3 weft, 1 warp, 1 weft, and 1 warp, and say what the stroke of tappet should be to form a proper shed for shuttle to pass through; shuttle 2 inches broad, 1 1/2 inches deep; stroke of going part, 8 inches; heads, 14 inches from the cloth; length of treadle, 32 inches; friction roller, 24 inches from treadle pin; half moon, 7 1/2 inches; jacks, 10 inches; diameter of friction roller, 4 inches. (Draw to 1/2 size.)

42. Give a drawing of a Jacquard machine, with neckbands attached (double lift), showing 8 hooks, cylinder, needles, and spring box in position, state what advantages it possesses over a dobbie and single lift Jacquard.

43. Combine a 10-end twill (4 warp, 4 weft, 1 warp, 1 weft), with a 6-end twill (3 warp and 3 weft), end and end; work out fully on point paper, and say how many ends and picks will be required to complete the pattern.

44. Give a description both of a rising and a circular box for looms, and say what class of goods each are adapted for.

45. Why, in weaving some classes of plain goods (dyed yarns) is it advisable to weave with more than one shuttle? What would be likely to be the effect in the piece, providing the goods were woven with one shuttle?

46. Make a stripe design 16-ends plain gauze, 16-ends 2 and 2 twill, 32-ends gauze (2 ends crossing 2 ends), and 32-ends plain cloth; and give draft for same to weave on least possible number of heads.

47. Calculate the cost of material in a piece made as follows:—50 ends per inch, of 2 fold 60's worsted warp at 2/9 per lb.; 60 ends per inch of 2/40's cotton warp at 1/6 per lb.; 60 picks per inch of single 32's worsted weft at 9/- per gross (gross = 44 lbs.); 40 picks per inch of single 40's cotton weft at 1/4 per lb., piece to be woven 27 inches in the reed, 52 yards long, from 56 yards of warp.

48. State by what methods a large repeat of pattern may be got from a small Jacquard.

49. A piece contains 180 hanks of weft, there are two colours, the proportion of each being 36 and 14 respectively; what number of hanks of each does the piece contain?

19C.—LINEN MANUFACTURE.

SECTION I.—FLAX SPINNING.

INSTRUCTIONS.

The candidate must confine himself to one grade only, the Ordinary or Honours. He must not answer questions in more than one grade. If he has already passed in Linen Manufacture, in the first class of the Ordinary Grade, he must select his questions from those of the Honours Grade of this subject. Three hours allows for this paper. Candidates are not expected to answer more than ten questions; but they are required to select at least five from the last twelve questions in either grade. The maximum number of marks obtainable is affixed to each question.

ORDINARY GRADE.

1. State the broad limits within which the flax plants may be considered indigenous: and the narrower limits within which its cultivation, for textile purposes, has been proved most suitable. (80.)

2. When flax starts from the ground, how many

seed leaves are developed; what height does the plant usually attain; and, in the globular capsule following the flower, how many seeds are generally to be found? (100.)

3. Have any experiments been lately made in saving Irish seed, and with what results? (80.)

4. What are about the average per centages of oil and cake resulting from the crushing of flaxseed; what are the general characteristics of linseed oil; and to what uses is it generally applied? (100.)

5. What is the shortest time which should elapse between two crops of flax on the same field; and, in the United Kingdom, what is considered the most favourable position in the rotation for flax? (80.)

6. What three changes in the plant does the farmer generally look for, as showing that it has arrived at maturity, and that, consequently, the time has arrived to pull? (100.)

7. In retting—why should the beets not be tied too tightly; and, in an ordinary flax dam, how may a farmer judge, roughly, of the advance of the retting process, from observing the alterations he has to make in weighting down the flax? (100.)

8. Assuming the flax-straw to have been properly placed in a suitable retting-dam, what two circumstances contribute to the uncertainty as to the length of time required for properly retting the flax. (80.)

9. To what three points, in connection with his flax-straw, should the farmer pay most particular attention, in order to get the best possible result from the scutching process? (100.)

10. Under what circumstances is hand-scutching preferable to mill-scutching? (60.)

11. Under what general selections, and under what marks is Parnau flax usually shipped; and, if the usual base-mark is quoted at £24 per ton, what are the relative scale values of the other marks? (80.)

12. Speaking generally, would prolonged storage, after scutching, be likely to improve, or to injure, the quality of the flax-fibre; and would you consider such improvement, or injury, as likely to be transitory or permanent? (100.)

13. Some continental spinners cut all their flaxes (even the coarser) before hackling—describe the advantages and disadvantages of this system; shewing how it affects all the subsequent manufacturing processes. (80.)

14. Describe the stripping-motion of the Horner "stripping-rod" hackling machine—giving, if possible, a rough sketch, in section, shewing positions in sheets, stripping-rods, etc. (100.)

15. Describe the work performed, in a tow card, by the cylinder, strippers, workers and doffers respectively. (100.)

16. In the three-doffer card—why is the sliver of the top doffer sometimes taken off separately? (60.)

17. The sliver is pinning badly in the gills of a drawing frame—what defects in the yarn would this be likely to cause; and how would you proceed to remedy the evil? (60.)

18. In an ordinary roving-frame, to produce a properly made rove the speeds of four of the principal organs have, necessarily, to be taken into account—(1) name these four organs; (2) in how many of them do the speeds remain constant? and (3) in those which vary, to what is their variation, in each case, proportional? (100.)

19. Why is unremitting attention to rove-traverses such an important part of the duties of a spinning-room over-looker? (60.)

20. Describe any (more or less) automatic systems with which you may be acquainted for (1) lubricating spindles; (2) dragging bobbins; and (3) cleaning rollers of spinning-frames—giving your opinion as to their practicability, utility, cost, &c.? (100.)

21. Give a rough sketch, shewing driving arrangement—with tread (stop) motion—for a double power-reel. (80.)

22. Assuming you have a well-arranged drying loft—(1) what temperature (Fahr.) would you recommend for drying any average counts of yarn you may be acquainted with; (2) how would you place the finer yarns, and how the coarser, with respect to the position of the heat supply; and (3) what arrangements would you make to minimise the effects of "sweating"? (100.)

23. Can you suggest any changes likely to improve the health of the workpeople in the hackling, carding, and preparing departments, without interfering sensibly with the proper treatment of the material? (80.)

24. About what I.H.P. per 1,000 spindles (machinery in all the departments included) would you consider a fair basis of calculation, for an average-sized mill, spinning medium numbers—and, what variation in this figure might be reasonably reckoned on, as between an experiment made at, say, seven a.m., and another at twelve noon? (100.)

HONOURS GRADE.

1. Examined under the microscope, what differ-

ences are discernable between the fibres of flax and of cotton, as to (1) form; (2) length; and (3) colour? (80.)

2. Describe firing, or black rust, on the flax plant—(1) what causes it; (2) when is it usually most prevalent; (3) what should the farmer do when he notices his crops affected by it; and (4) how does it affect, ultimately, the quality, etc., of the fibre? (100.)

3. Describe how you would proceed to test flaxseed, as to germinating power; and, if the seed had been mixed (either with that of another district, or of another season), would your test point to such admixture? (100.)

4. Two samples of Dutch flaxseed have been purchased:—(a) price per hogshead, 50s.; purity, 98.00 per cent.; germinating power, 92.00 per cent.; (b) price per hogshead, 45s.; purity, 90.00; germinating power, 88.00 per cent.; what, from above data, are the agricultural values of the two seeds? (60.)

5. Describe probable results to be expected from sowing flax (1) on land with a stiff clay subsoil; and (2) on peaty or sandy soils, with a poor bottom. (80.)

6. Discuss the questions—(1) as to whether the surface of the ground should be (a) rolled; or (b) gently broken up, to receive the flaxseed; (2) should clover or rye grass be laid down with the flax—if so, should they be sown (a) before; or (b) after the rolling, which follows the sowing of the flax? (100.)

7. What four or five tests (more or less mechanical) does a farmer usually employ to judge if his flax has been sufficiently retted; and what other tests are sometimes employed—in Belgium, Holland, and Russia—for a similar purpose? (100.)

8. Describe the principles on which the three, so-called, artificial retting systems of Schenck, Watts, and Parsy are founded; and give the general characteristics of the fibres produced by each method. (100.)

9. On what three different principles have machines for flax-cleaning been successively designed giving an example of each class; and which principle, up to the present, has been most approved of by flax users; and for what reasons? (100.)

10. In the scutching process, in addition to the woody matter requiring, necessarily, to be removed from the flax-straw, what percentage, roughly, of fibre is also taken off, in the form of tow? (60.)

11. If cost of production per statute acre be taken at, say, £8—rent, taxes, and seed figuring for about £3—give your opinion as to the relative proportions to be set down against (1) preparation of soil, including pulling; (2) retting, including grassing; and (3) scutching. (100.)

12. To what six points, in connection with Russian (especially Riga) flax, has attention lately been directed, with a view to effect improvement; and what action is the Russian Government reported to have lately taken, to revive and extend the flax industry? (100.)

13. Discuss the advantages and disadvantages of spreading line direct from the hackling machine (without going through the sorting process)—shewing effect on cost of material, and quality, &c., of yarn; and stating what description of fibre lends itself most readily to this method of treatment. (80.)

14. Describe the differences in design of the sheet arrangements on the Horner and Cotton hackling machines—as to rollers, hackle-bars, attachment of the hackles, details of the strike-in motions, etc. (100.)

15. Taking the development (or surface speed) of a card cylinder to be represented by 1,000—what would be, very roughly, the average developments of the strippers, workers, and doffers? (100.)

16. State the arguments for and against tow-combing; and give, roughly, a description of any tow-combing machine with which you may be acquainted. (100.)

17. A roving-frame produces a rove which, while too soft, looks "dragged"—how would you correct these two evils? (60.)

18. In the differential-motion on an ordinary roving frame—prove the correctness, or otherwise, of the following statements, viz., that (1) for tension, the rotary movement of the bobbins varies, in inverse ratio, to the circumference to be wound on; and (2) for proper build of the rove, the speed of the builder is inversely proportional to the diameter of the rove on the bobbin. (100.)

19. (1) What is ring-spinning—how would its adoption probably affect (a) the twist; and (b) the turn-off; (2) for spinning yarn on cops—give rough sketch of spindle, flyer, and form of cop employed; explaining how the build is managed, in view of the drying operation to follow? (100.)

20. Describe beaded yarn—stating how generally caused, and how best prevented. (60.)

21. You require to make some new reed-barrels—how would you design proper form and length of spoke which, when flies are attached, would produce proper size of barrel? (80.)