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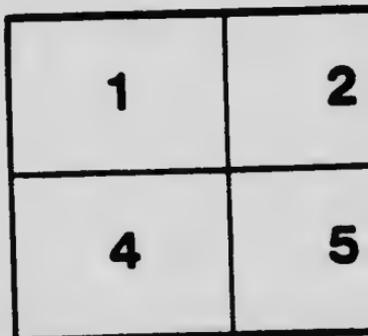
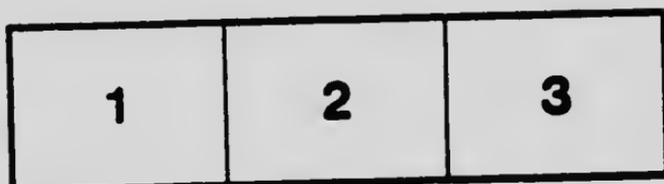
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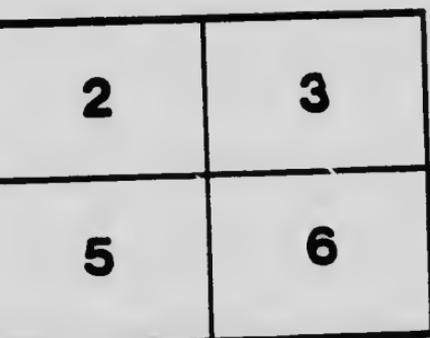
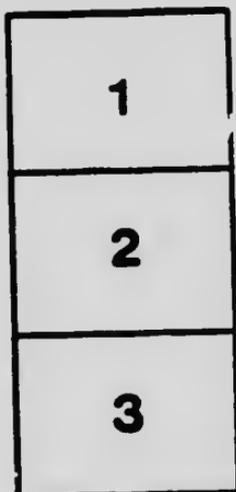
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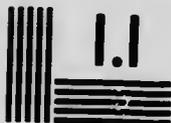
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**MOTIVE POWER DEPARTMENT.**

**FIRST SERIES OF QUESTIONS**

**FOR THE**

**PROGRESSIVE MECHANICAL EXAMINATIONS**

**OF**

**FIREMEN.**

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# **INSTRUCTIONS**

## **FOR THE USE OF**

### **PROGRESSIVE MECHANICAL EXAMINATION QUESTIONS**

I. For the purpose of assisting firemen to acquire the knowledge necessary to render them competent and efficient engineers, to indicate to them the subjects which must be understood, and the course of study that must be pursued to fit them for promotion, and allow each man the proper opportunity to pass the required examinations, three sets of progressive questions have been prepared, which together constitute the examinations on mechanical subjects which must be passed by a fireman before promotion to an engineer.

II. When a man is first employed as a fireman he will be given the first book of questions on which he will be examined at the end of his first year in the service ; after passing this first examination he will be given the second book of questions, on which he will be examined after not less than nine or more than fifteen months additional service ; after passing this second examination he will be given the third and final set of questions on which he will be examined after not less than three years total service as a fireman, and not more than fifteen months after passing the second examination.

III. The examination for the first and second set of questions will be conducted by the road foreman of the division on which the fireman is employed ; the examination in the third set of questions will be conducted by not less than three road foremen, two of whom must be from other divisions than the one on which the fireman is employed, sitting as a general board of examiners.

IV. At any of the examinations 80% of the questions asked must be answered correctly, and when questions are divided into classes such as air brake, machinery, etc., 80% of each class must be answered correctly in order to pass the candidate.

V. Any fireman failing to pass any of the examinations will be given a second trial, not less than two months or more than five months later on the same set of questions, if he then fails to pass he will be placed at the foot of the seniority list or his services dispensed with at the option of his Master Mechanic.

VI. Firemen who pass the third and final series of questions will be eligible for promotion to engineers without further examination on mechanical questions.

VII. Men employed as engineers who have had service on other roads, will be required to pass the third series of questions before entering the service.

VIII. A memorized answer to the questions is not sufficient, the full meaning of each answer must be understood and the examiners will ask any further questions bearing on the subject that may be necessary to ensure this.

IX. After passing each examination the question book must be returned to the proper division officer.

# **FIRST SET**

**OF**

## **PROGRESSIVE QUESTIONS**

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### **LOCOMOTIVE QUESTIONS**

- 1.—What are the duties of a fireman on his arrival at the engine house previous to his going out on trip?
- 2.—Have you acquired the habit of comparing the time with your engineer, and do you insist on seeing the train orders?
- 3.—Upon reaching your engine what are your first duties?
- 4.—What is the composition of bituminous coal?
- 5.—What are the heat producing substances in the coal?
- 6.—Of what does burning or combustion consist, and what three things are essential to produce it?
- 7.—From what source do we draw the oxygen that burns the carbon and gases?
- 8.—How is forced draft created in a firebox and why is it necessary?
- 9.—Describe the condition in which your fire should be when ready for the trip and say what you would do to get it in that condition?
- 10.—State how you would fire the engine while she was running along working to obtain the best results.
- 11.—Describe the appearance of the fire when best results are being obtained.
- 12.—Where should the coal, as a rule, be placed in the the firebox?
- 13.—Why is it very important that the coal should be broken so that it will not be larger than an ordinary apple before being placed in the firebox?

14.—In what condition should the fire be maintained in regard to its depth or thickness?

15.—Does the amount of air admitted to the firebox have any bearing on the amount of coal consumed or the heat produced? Say why.

16.—In what way does the condition of the fire with regard to depth, holes, banks or clinkers, affect the admission of air?

17.—What are the evil effects of too strong a draft?

18.—What bad effects would follow from carrying (a) too heavy a fire? (b) too light a fire?

19.—If, while the engine were standing, the fire were to become very light and thin and a heavy train were then to be lifted what would be the effect on the fire?

20.—What harm is done from putting more than 3 or 4 scoops of coal on the fire at one time under ordinary working conditions?

21.—Other conditions being the same which would give the better results in burning fuel,—a wide firebox with 50 square feet of grate surface or a narrow fire box with a grate area of 30 square feet? Why?

22.—What are the advantages of utilizing the total grate surface?

23.—How can you prevent good coal being pulled through the flues and out of the stack?

24.—Is there a serious loss from this cause? If so, what conditions are there that increase it or make it less?

25.—What causes a pull on the firebox door when the engine is working?

26.—Do you consider it beneficial or otherwise to have banks or holes in the fire and why?

27.—What will cause the engine to tear holes in the fire?

28.—What causes an engine to bank her fire, and how would you guard against them and remove them when formed?

29.—When fire burns most in front of firebox what does it denote?

30.—When fire burns most in back of firebox what does it denote?

31.—If an engine burns her fires in either way what can you do to make it work better?

32.—When and for what purpose is the use of the rake on the fire allowable?

33.—What are the effects, good and bad, of raking the fire while the engine is working?

34.—Describe the ashpan and say what its uses are.

35.—Why are the dampers and netting provided in the ashpan?

36.—Why are the grates made to shake and when should they be shaken?

37.—Does any loss occur from a too frequent shaking of the grates? From a too severe a shaking?

38.—If clinkers form on the grates what will be the effect on the burning? Say how you would avoid them.

39.—What will be the effect of allowing the ashpan to become filled with ashes and clinkers?

40.—Do you consider it beneficial or otherwise, to admit air to the firebox above the surface of the fire? Give your reasons.

41.—What effect does the opening of the firebox door have on the fire?

42.—Is it a good practice to leave the firebox door open longer than is absolutely necessary while the engine is working? Say why.

43.—What is black smoke and is it combustible?

44.—Why does black smoke clear up so quickly when firebox door is opened?

45.—What effect has the stoppage of a number of tubes?

46.—What harm may follow if a bank were allowed to form and remain against the tube sheet?

47.—Has improper firing any tendency to cause the tubes to leak, and how?

48.—How would you care for a boiler with leaky tubes or firebox?

49.—What advantages are derived from an arch in a locomotive firebox?

50.—(a) What is meant by atmospheric pressure?

(b) What pressure is indicated by the steam gauge?

51.—At what temperature does water boil under atmospheric pressure at sea level?

52.—Is there any difference in the temperature of water at the boiling point under atmospheric pressure and under a pressure of 200 lbs?

53.—About what is a fair average quantity of water which should be evaporated in a locomotive boiler per pound of coal consumed?

54.—About what should be the height of the water level in the boiler when all is ready for starting on the trip?

55.—Can the firing be done more intelligently if the water level is observed closely? Why?

56.—Why is it desirable that a uniform boiler pressure be maintained?

57.—Is it any advantage to a fireman to know the grades of the road and the location of the stations?

58.—What is the purpose of a safety valve on a locomotive boiler? Why is more than one used?

59.—What should be done to prevent waste of steam through the safety valve?

60.—What is the estimated waste of coal for each minute the safety valve is open?

61.—Is it not a waste of fuel to open firebox door to prevent pops from opening? How can this be prevented more economically?

62.—What should be the condition of the fire when passing over the summit of a long grade?

63.—What should be the condition of the fire when arriving at a station where a stop is to be made? When arriving at a terminal?

64.—What are the duties of a fireman on arrival at the terminal?

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First...

### AIR BRAKE QUESTIONS.

1.—What are the essential parts of the air brake as applied to a locomotive?

2.—How is the air compressed for use in the brake system?

3.—How many kinds of triple valves are there in use?

4.—What is the main reservoir used for and where is it usually located?

5.—What is the usual standard train pipe pressure?

6.—What is the standard main reservoir pressure carried on this system:

(a) With ordinary governor?

(b) With duplex governor?

7.—Why is it important that all air brake apparatus should be kept tight and free from leaks?

8.—Where does the air come from that operates the sand blower, bell ringer, air signal whistle and other devices?

9.—Explain how an air pump should be started and run on the road.

10.—How should the steam end be oiled?

11.—How should the air end of the pump be oiled, and what kind of oil used?

12.—How is the automatic brake applied and released?

13.—(a) How many positions are there of the brake valve? (b) What are they?



