

**“Construction Materials Engineering”  
Examination Questions**

**Test 1**

**Theme: Bases of metallurgical manufacture**

1. How take active metals from ore?
2. What is the difference between ore and concentrate?
3. Problem of *metallurgical manufacture*.
4. Structure of *metallurgical manufacture* (the ferrous metallurgy enterprises).
5. Raw materials for ferrous metallurgy.
6. Ferrous metallurgy production.
7. The primary goal of ferrous metallurgy.
8. *Blast furnace* (appearance, characteristics).
9. *Units for steel melt* (appearance, the brief characteristics).
10. 3 stages of *steel making*.
11. Ways of *steel pouring*.
12. Ways of *steel quality improvement*.
13. *Reception of iron* from ores out of a *blast furnace*.
14. Prospects of development of ferrous metallurgy.

**Theme: Processing of metals by pressure**

1. Definition of *metals processing by pressure*.
2. Advantages of processing by pressure in comparison to other kinds of treatment.
3. 3 stages of metal reaction on loading.
4. Basic laws of plastic deformation.
5. What for it is necessary to know  $t_r$  (*recrystallization temperature*)?
6. *Cold and hot plastic deformation*: essence, change of metal properties.
7. How to choose a *temperature range* for processing by pressure?
8. *Furnaces* and *electric heating devices* for billets heating.
9. Classification of metal processing by pressure.
10. What is the *machine-building shape*?
11. *Rolling*: *longitudinal*, *cross*, and *helical* schemes.
12. *Angle of nip* and *condition of rollers bite* of metal.
13. The tools for rolling. What is the *pass*?
14. *Working line of the rolling mill* (a scheme).
15. Function of supporting rollers in multiple-roll stands.
16. Classification of rolling mills.
17. What is the *assortment*?
18. Production of rolling manufacture.
19. Definition of *pressing*. Schemes of *direct* and *reverse pressing*. Deformation upon pressing.
20. Equipment and tools for pressing.
21. Pressing production.
22. Advantages and disadvantages of pressing.
23. Definition of *drawing*. Scheme of the process. Features of deformation upon drawing.
24. Equipment and tools for drawing.
25. Advantages and disadvantages of drawing.

26. Definition of *forging*. The scheme. Features of deformation upon forging.
27. Equipment and tools for forging.
28. Application, advantages and disadvantages of forging.
29. *Hot die forging*: definition, schemes of die forging in the open and closed stamps.
30. Equipment and tool for hot die forging.
31. Advantages and disadvantages of hot die forging in comparison with free forging.
32. *Cold sheet-metal stamping*: definition, schemes.

## Test 2

### Theme: Foundry production

1. Foundry problem.
2. The scheme of foundry process.
3. Foundry properties of alloys: 1) *fluidity*; 2) linear and volume *shrinkage*; 3) hot and cold *cracks* formation and *distorting*; 4) *gas bubbles* formation and *porosity*.
4. What type of imperfections the shrinkage leads to?
5. How to prevent the *shrinkage cavity* formation?
6. Demands for *sand mixes*.
7. Types of sand mixes.
8. Foundry equipment: *a mould, a pattern, a core, a flask, a half-mould, a gating system*.
9. Sequence of the mould manufacture for manual moulding.
10. What operations machine moulding mechanizes?
11. Compacting of sand mix by pressing, by shaking and by sand-throwing machine.
12. Assemblage of moulds, pouring, cooling and *knock-out* of castings, *fettling* and *cleaning* of castings.
13. *Shell casting*.
14. *Investment casting*.
15. *Chill casting*.
16. *Pressure casting*.
17. *Centrifugal casting*.
18. *Cavityless casting*.
19. Imperfections of mould pieces.

### Theme: Welding fabrication

1. Welding *by fusion* and welding *by pressure*.
2. What is a *welding arc*? Scheme of welding arc.
3. Striking the arc.
4. *Static volt-ampere characteristic* of the arc. Which segment corresponds to manual arc welding?
5. Features of arc burning while an alternating current is used.
6. Equipment for manual arc welding.
7. Power supplies for welding arc.
8. Why for manual arc welding sources with high-angle falling characteristics are used only?
9. How current strength is regulated for manual arc welding?
10. What is a *welding electrode*? Necessity of electrode *coating*.
11. Scheme of manual arc welding process.
12. *Parameters* of manual arc welding *mode*.
13. Classes of *welding joints*.
14. Spatial positions for welding.
15. *Automatic submerged* arc welding. Scheme, equipment, materials, advantages, application.
16. *Automatic flux-cored* arc welding.

17. *Automatic gas metal arc* welding.
18. *Gas* welding. Equipment, scheme, advantages, application.
19. *Resistance* welding. Why do the edges of welded parts heat up?
20. *Flash butt* welding and *upset butt* welding. Scheme of process. Application.
21. *Resistance spot* welding. Scheme of process. Application.
22. *Resistance seam* welding. Scheme of process. Application.
23. *Cold* welding. Scheme of process. Application.
24. *Friction welding*. Scheme of process. Application.
25. *Soldering*. Methods. Materials.
26. Defects of welded joints.

### Test 3

#### Theme: Metals cutting (Machining)

1. Definition of ***processing by cutting***.
2. Classification of movements in metal-cutting machine tools.
3. Schemes of cutting operations (*processed* and *finished surfaces*, *principal cutting movement* and *feeds*).
4. Parameters of *cutting mode*: *speed of cutting movement*, *feed*, and *depth of cutting*.
5. Geometry of a turning cutter. Cutter angles.
6. Chip formation. Kinds of chips.
7. How heat evolution upon cutting is reduced?
8. Tool wearing. Criterion of wearing.
9. *Tool durability*. Dependence between tool durability and speed of cutting.
10. The basic units of *lathe*.
11. Operations made by lathes (schemes of tools and cutting movements).
12. Specific features of *milling*.
13. The basic units of *horizontal-milling machine*.
14. Operations made by milling machines (schemes of mills and cutting movements).
15. Specific features of *planing* and *shaping*.
16. The basic units of *shaping machine*.
17. Operations made by shaping machines (schemes of cutters and cutting movements).
18. Specific features of *drilling*.
19. What is *a drill*, *a core drill*, *a reamer*?
20. Operations made by drilling machines.
21. *Grinding*. The method characteristic.
22. *Finishing by cutting*.
23. *Finishing by plastic deformation*.
24. *Electro-physical processing*.
25. ***Machining accuracy*** and ***surface quality***.

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ  
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УНИВЕРСИТЕТ»**

## **ИНСТИТУТ ФИЗИКИ ВЫСОКИХ ТЕХНОЛОГИЙ**

Discipline  
**«PROCESSING OF STRUCTURAL  
MATERIALS»**

**TEST № 1**



1. Problem of *metallurgical manufacture*.
2. Equipment and tools for forging.
3. What imperfections the shrinkage leads to?
4. Power supplies for welding arc.
5. Parameters of *cutting mode*.

Составил  
«12» декабря 2014 г.

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**TEST № 2**



1. Raw materials for ferrous metallurgy.
2. Advantages of processing by pressure in comparison to other kinds of treatment.
3. Foundry equipment for sand casting.
4. What is a *welding arc*? Scheme of welding arc. Striking the arc.
5. Geometry of a turning cutter.

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**TEST № 3**



1. Ferrous metallurgy production.
2. *Cold and hot plastic deformation.*
3. *Chill casting.*
4. What type of supply characteristic is necessary for manual arc welding?
5. Operations made by milling machines.

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TEST № 4



1. 3 stages of *steel making*.
2. What for it is necessary to know  $t_r$  (*recrystallization temperature*)?
3. *Investment casting*.
4. *Automatic submerged arc welding*.
5. The basic units of *lathe*.

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TEST № 5



1. Ways of *steel pouring*.
2. *Furnaces* and *electric heating devices* for billets heating.
3. *Shell casting*.
4. Equipment for manual arc welding.
5. Specific features of *milling*.

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**TEST № 6**



1. *Ways of steel quality improvement.*
2. *Rolling: longitudinal, cross, and helical schemes.*
3. *Pressure casting.*
4. *What is a welding electrode?*
5. *Operations made by lathes.*

Составил  
«12» декабря 2014 г.

И.А. Хворова

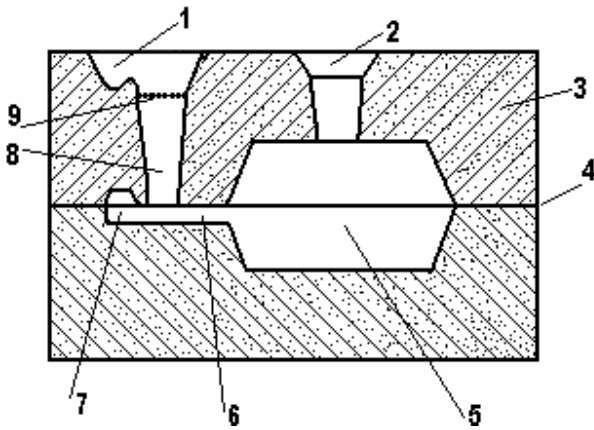
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**Foundry production. Welding fabrication**

**Test 1**

Test 1 Name the positions specified in the drawing.



- 1 –
- 2 –
- 3 –
- 4 –
- 5 –
- 6 –
- 7 –
- 8 –
- 9 –

Test 2 What can hinder the shrinkage of castings?

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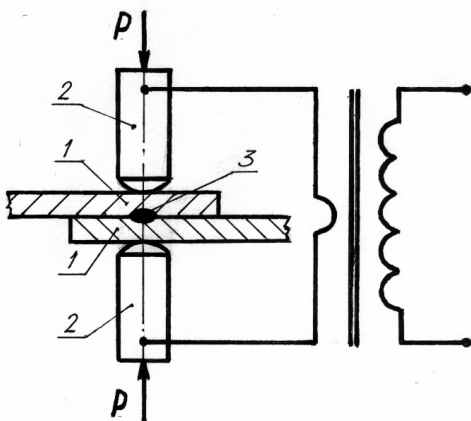
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Test 3

1. What way of welding is represented in drawing?
2. Name the positions designated in drawing.
3. Specify scopes of this way of welding.




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Test 4 How current strength is regulated upon manual arc welding?

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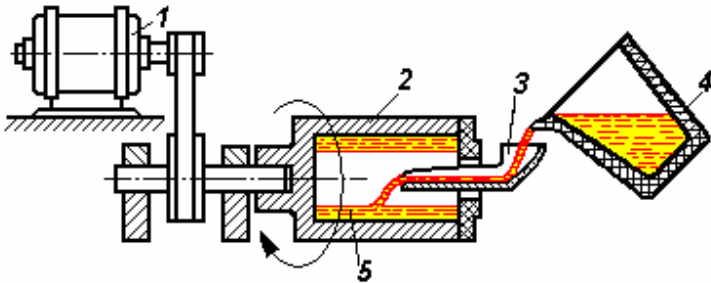
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## Test 2

Test 1 What way of casting is shown in the picture? For what products manufacturing is this method applied?



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Test 2 List the foundry properties of alloys.

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Test 3 What is a *welding arc*? Draw a scheme of welding arc.

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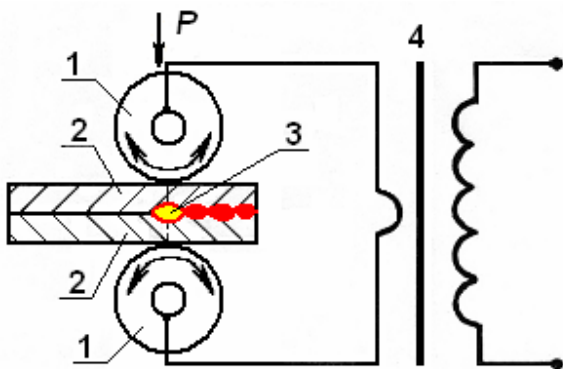
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Test 4 What way of welding is represented in the drawing? Name the positions designated in the drawing. Specify scopes of this way of welding.



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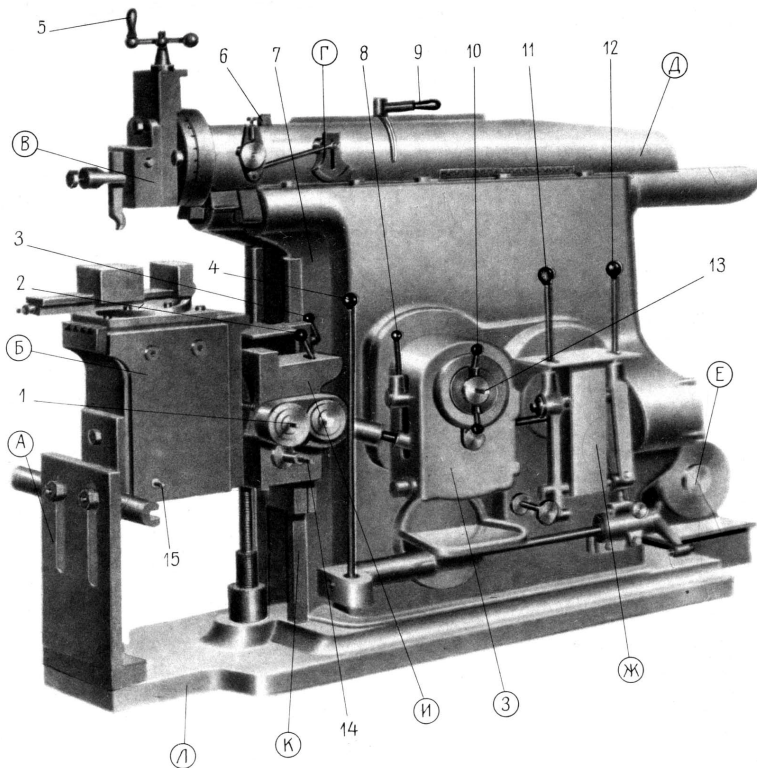
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## Cutting (Machining)

### Test 3

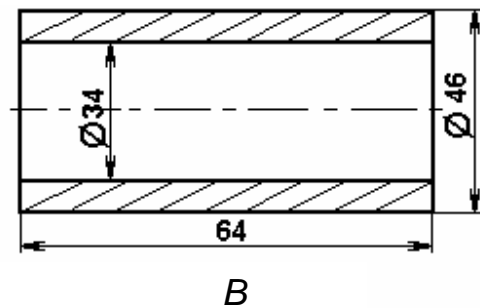
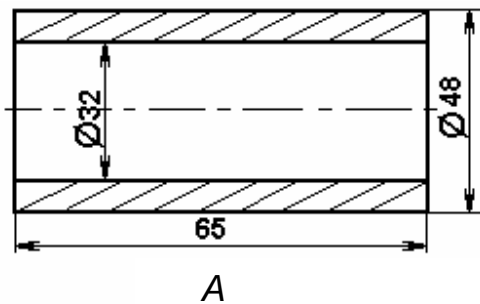
#### Task 1

1. What is the name of a machine tool in the photo?
2. What kinds of work is it intended for?
3. Specify the basic units of the machine tool and a direction of their moving, the principal movement and feeds.
4. What device a work-piece and the tool are fixed in?



#### Task 2

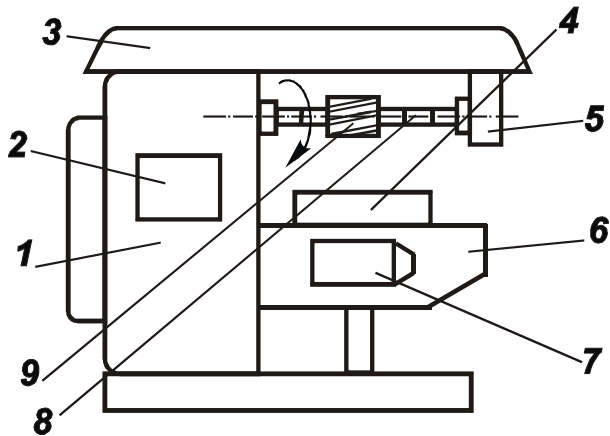
By what machine tool and by what operations and tool is it possible to make a part *B* from work-piece *A*?



## Test 5

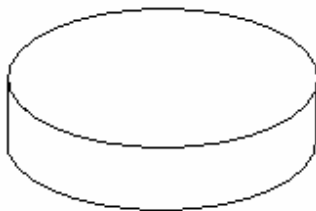
### Task 1

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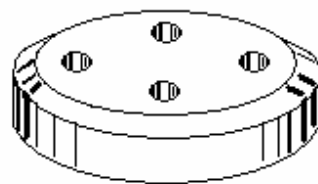


### Task 2

What kinds of the equipment and what tool is required for serial manufacturing of parts *B* from work-piece *A*?



*A*



*B*