PRACTICE QUESTIONS

for SSC-JE : CBT-2

Production Engineering

Mechanical Engineering

08 Production Engineering

Q.1 For the allotropic forms of iron, the points of arrest are :
(a) where no further flow of metal takes place.
(b) constant for all metals.
(c) the points of discontinuity.
(d) where no further change occurs.

Q.2 Sulphur in pig-iron tends to make it
(a) harder (b) softer
(c) more ductile (d) tougher

Q.3 The strain hardening exponent n for stainless steel with distinct yield and ultimate tensile strength values undergoing plastic deformation is
(a) $n < 0$ (b) $n = 0$
(c) $0 < n < 1$ (d) $n = 1$

Q.4 Consider the following statements about heat treatment processes :
1. The spheroidising process is usually applied to high carbon tool steels which are difficult to machine.
2. In spheroidising process, the cementite in the granular form is produced in the structure of steel.
3. The annealing process causes complete recrystallization in steels which have been severely cold worked and a new grain structure is formed.

Which of these statement(s) is/are wrong?
(a) 1 and 2 (b) 1 and 3
(c) 2 and 3 (d) None of these

Q.5 Consider the following statements about machine tools:
1. In shaper, tool head is mounted on cross rail.
2. Knee of milling machine is attached and slides up and down on column.
3. Plain milling cutters have teeth only on their periphery.

Which of the above statements is/are incorrect?
(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) None of these

Q.6 Shear velocity during machining process is 1.2 m/s with chip thickness ratio of 0.6. Shear angle is 30° and rake angle is 15°. What is the value of cutting velocity? [Take sin15° = 0.261, cos15° = 0.96]
(a) 0.33 m/s (b) 0.43 m/s
(c) 1.20 m/s (d) 0.13 m/s

Q.7 Which of the following defects occurs due to flux employed and electrode coating?
(a) Inclusion of slag
(b) Inadequate penetration
(c) Incomplete fusion
(d) Porosity

Q.8 Consider the following statements about wrought iron:
1. It melts at 1535°C.
2. It is very soft and ductile.
3. It is made by adding suitable percentage of carbon to molten iron and subjecting the product to repeated hammering and rolling.
4. It can be easily forge welded.

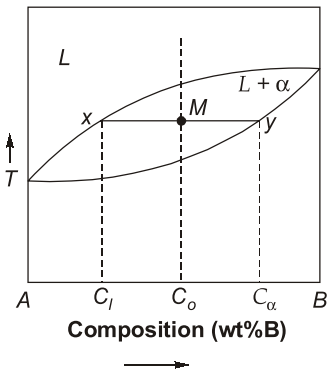
Which of these statements are correct?
(a) 1, 2 and 3 (b) 1, 2 and 4
(c) 1, 3 and 4 (d) 2, 3 and 4

Q.9 Which of the following material has maximum ductility?

(a) Mild steel (b) Copper
(c) Nickel (d) Aluminium

Q.10 The casting ability of aluminium increases when _____ is added to aluminium.
(a) Copper (b) Magnesium
(c) Silicon (d) Lead and bismuth

Q.11 What is the equation for the liquid mass fraction at point M in the following binary phase diagram?



(a) $\frac{(C_\alpha - C_o)}{(C_\alpha - C_l)}$ (b) $\frac{(C_o - C_l)}{(C_\alpha - C_l)}$
(c) $\frac{C_\alpha}{(C_\alpha - C_l)}$ (d) $\frac{C_o}{(C_\alpha - C_l)}$

Q.12 Carburization is a heat treatment used for case hardening steels, carbon is trapped on steel surface by:
(a) Osmosis
(b) Interstitial diffusion
(c) Vacancy diffusion
(d) None of these

Q.13 If sprue area is 2.67 cm^2 and gating ratio is 1 : 2 : 3, then area of runner is
(a) 2.67 cm^2 (b) 5.34 cm^2
(c) 8.01 cm^2 (d) Data insufficient

Q.14 The thickness of the blank needed to produce, by power spinning a missile cone of thickness 4 mm and cone angle 60°, is
(a) 4.62 mm (b) 3.46 mm
(c) 6.92 mm (d) 8 mm

Q.15 For an orthogonal cutting following data were observed,
Uncut chip thickness = 0.55 mm
Width of cut = 3 mm
Yield shear stress = 280 N/mm^2
If chip shear angle is 30°, then shear force will be
(a) 462 N (b) 924 N
(c) 231 N (d) 533 N

Q.16 Match List-I (**Code**) with List-II (**Operation**) and select the correct answer using the codes given below:

List-I
A. G 81
B. G 85
C. G 82
D. G 86

List-II
1. Drilling
2. Boring
3. Counter Boring
4. Riming

Choose the correct option using the codes given below:

Codes:

	A	B	C	D
(a)	1	3	4	2
(b)	2	3	4	1
(c)	2	4	3	1
(d)	1	4	3	2

Q.17 A metric thread of pitch 3 mm and thread angle of 60° in inspected for its pitch diameter using a 3 wire method, then diameter of wire is
(a) 1 mm (b) 3 mm
(c) $2\sqrt{3}$ mm (d) $\sqrt{3}$ mm

Q.18 Consider the following statements regarding sine bar:
1. It is used for indirect measurement of angle of a machined surface.
2. Two rollers of exact size are attached to the body of sine bar.

3. Sine bars can measure angle beyond 45° precisely.

Which of these statement(s) is/are correct?

(a) 2 only (b) 1 only
(c) 1 and 2 only (d) 1, 2 and 3

Q.19 Consider the following statements regard slip planes:

1. High atom density.
2. Low atom density.
3. Closely placed atoms.
4. Loosely placed atoms.
5. Direction of slip plane is along shortest translation vector.

Which of the above are correct where slip plane occurs?

(a) 1 and 3 (b) 2 and 4
(c) 1, 3 and 5 (d) 2, 4 and 5

Q.20 What is the shape of a stress strain curve for ceramics?

(a) Hyperbola (b) Parabola
(c) Inverted parabola (d) Straight line

Q.21 The angle between [1 1 1] and $[1\ 1\ \bar{2}]$ direction in cubic crystal is

(a) 0° (b) 30°
(c) 45° (d) 90°

Q.22 Which of the following is a point imperfection?

1. Vacancy
2. Interstitial
3. Frenkel imperfection
4. Schottky imperfection

(a) 1 and 2 (b) 2 and 3
(c) 2, 3 and 4 (d) 1, 2, 3 and 4

Q.23 Consider the following statements:

1. In gray cast iron, free graphite structure seems to act as lubricant.
2. White cast iron widely used for producing of wrought iron.
3. Spheroidal graphite iron also known as nodular cast iron.
4. Wrought iron can be hardened also tempered like steels.

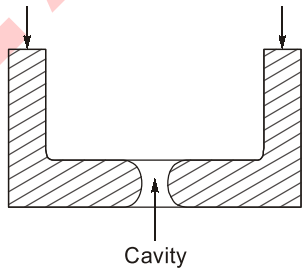
Which of the above statement(s) is/are correct?

(a) 1, 2 and 3 (b) 1, 2 and 4
(c) 2, 3 and 4 (d) 1, 2, 3 and 4

Q.24 Iron-carbon diagram and the TTT curves are determine under

(a) Equilibrium and non-equilibrium conditions respectively.
(b) Non equilibrium and equilibrium conditions respectively.
(c) Equilibrium conditions for both.
(d) Non-equilibrium.

Q.25 The casting defect shown below is



(a) Mirror (b) Outrun
(c) Cold shut (d) Hot shut

Q.26 In atomisation method of powder production, the size of the particles formed depends on

1. The temperature of the metal
2. The rate of molten metal flow
3. Nozzle size
4. Jet characteristics

Select the correct answers using the code given below:

(a) 1, 2 and 3 (b) 2, 3 and 4
(c) 1, 3 and 4 (d) 1, 2, 3 and 4

Q.27 Which one of the following is not an extrusion defect?

(a) Bamboo defect

(b) arrowhead fracture
(c) Pipe defect
(d) Wavy edge or edge crack defect

Q.28 A metal sheet of thickness 4 mm is to be bent at an angle of 1 radian with a bend radius of 98 mm. The bend allowance will be
(a) 314.16 mm (b) 100 mm
(c) 99.32 mm (d) 312.02 mm

Q.29 Consider the following statements regarding rolling:
1. In one setting of rolls in a 3-high rolling mill, one gets three reductions in thickness.
2. Rolling requires high friction which increases forces and power consumption.
3. Hot rolling of ferrous metals is done without a lubricant.
4. Rolling very thin strips of mild steel requires large diameter rolls.

Which of the above statements are correct?
(a) 1 and 2 (b) 2 and 3
(c) 1, 2 and 3 (d) 2, 3 and 4

Q.30 Match List-I (**Gear train**) with List-II (**Application**) and select the correct answer using the codes given below:

List-I
A. Compound gear train
B. Epicyclic spur gear train with brake bands
C. Worm and worm wheel gear trains
D. Epicyclic bevel gear train

List-II
1. Automobile gear box
2. Automatic transmission of automobile
3. Speed reducers for lifts
4. Automobile differential

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	1	2
(c)	1	4	3	2
(d)	3	2	1	4

■■■■

Answer Keys

1.	(c)	2.	(a)	3.	(c)	4.	(d)	5.	(a)	6.	(c)	7.	(a)
8.	(b)	9.	(a)	10.	(c)	11.	(a)	12.	(b)	13.	(b)	14.	(d)
15.	(b)	16.	(d)	17.	(d)	18.	(c)	19.	(c)	20.	(d)	21.	(d)
22.	(d)	23.	(a)	24.	(a)	25.	(c)	26.	(d)	27.	(d)	28.	(b)
29.	(b)	30.	(a)										

Detailed Solutions

1. (c)

The points of arrest are the points of discontinuity in the allotropic forms of iron. On cooling iron front a high temperature, it display two arrest points. These change points occur at 1390°C and 910°C. Above 1390°C iron exists as BCC lattice but between 1390°C and 910°C its exists as FCC lattice.

2. (a)

Presence of sulphur tends to make iron hard and does not produce sound castings.

- Sulphur lowers the viscosity of molten metal and tends to make it hard and brittle.
- For most of the foundry purposes, the amount of sulphur is kept below 0.1%.
- In wrought iron, sulphur produces red-shortness and makes it brittle and unworkable.

3. (c)

The value of strain hardening exponent lies between 0 and 1.

For metals, $0.1 < n < 0.5$

4. (d)

- Spheroidising improves machinability of medium and high carbon steel. Samples are heated close to lower critical temperature and cooled extremely slowly in the furnace. Due to the formation of spheroids, machinability will improve. It produces round and globular form of carbides (cementite).
- During annealing, specimen is heated above upper critical temperature and held it there for some time and then cooled slowly in furnace. It relieves the stresses from cold working and refines grain size due to phase recrystallization and produces uniformity.

5. (a)

- In shaper, ram carries tool head.
- Knee of the milling machine is attached with base.

6. (c)

Given: $V_S = 1.2$ m/s, $\mu = 0.6$, $\phi = 30°$, $\alpha = 15°$

$$\frac{V_C}{\sin\phi} = \frac{V_S}{\cos\alpha} = \frac{V}{\cos(\phi-\alpha)}$$

Cutting velocity,

$$V = \frac{V_S}{\cos\alpha} \times \cos(\phi-\alpha)$$

$$= \frac{1.2}{\cos 15°} \times \cos(90° - 15°)$$

$V = 1.2$ m/s

7. (a)

Slag is formed by reaction of flux, stirring action may force to weld pool.

8. (b)

Wrought iron is a soft, ductile, fibrous variety that is produced from a semifluid mass of relatively pure iron globulus partially surrounded by slag. It usually contains less than 0.1% carbon and 1 to 2% slag.

10. (c)

With the addition of the silicon in the pure aluminium, it improve its fluidity.

11. (a)

C_α = Composition of solid

C_l = Composition of liquid

C_o = Composition of alloy

$$\text{Liquid mass fraction} = \frac{(C_\alpha - C_o)}{(C_\alpha - C_l)}$$

$$\text{Solid mass fraction} = \frac{(C_o - C_l)}{(C_\alpha - C_l)}$$

12. (b)

Carbon forms interstitial carbides with iron due to large difference in atomic radii.

13. (b)

Getting ratio = 1 : 2 : 3 ≡ Sprue : Runner : Gate

Runner area = 2 (choke area) = 2 (sprue area)

$= 2\,(2.67) = 5.34\ cm^2$

14. (d)

$$t_c = t_b \sin\alpha$$

$$4 = t_b \sin\left(\frac{60}{2}\right)$$

$$t_b = \frac{4}{\sin(30°)}$$

$$t_b = 8\ mm$$

15. (b)

$$F_s = \frac{\tau wt}{\sin\phi} = \frac{280\times 3\times 0.55}{\sin 30°}$$

$F_s = 924$ N

16. (d)

A.	G 81 →	1. Drilling
B.	G 85 →	4. Boring
C.	G 82 →	3. Counter Boring
D.	G 86 →	2. Reaming

17. (d)

For 3 wire method,

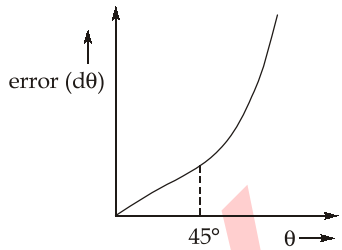
$$d_{wire} = \frac{P}{2}\sec\frac{\alpha}{2} = \frac{3}{2}\sec\left(\frac{60}{2}\right)$$

$d_{wire} = 1.5 \times 1.1547 = 1.732 = \sqrt{3}$ mm

18. (c)

Sine bars:

- It is used for indirect measurement of an angle of a machined surface.
- Two rollers of exact size are attached to the body of sine bar.
- Sine bars can not measure angle beyond 45° precisely because error is directly proportional to tanθ.



19. (c)

Slip planes occur in plane where high atom density i.e. atoms closely packed and direction of slip plane is along shortest translation vector.

20. (d)

The shape of a stress-strain curve for ceramics is straight line as after a point ceramic suddenly reaches fracture point and break.

21. (d)

Angle between [1 1 1] and $[1\ \ 1\ \ \bar{2}]$ given by

$$\cos\theta = \frac{1\times 1+1\times 1+1\times(-2)}{\sqrt{1^2+1^2+1^2}\times\sqrt{1^2+1^2+(-2)^2}} = 0$$

$\Rightarrow \quad \theta = 90°$

22. (d)

Types of point imperfection :

(a) Vacancy defect
(b) Interstitial defect
(c) Substitutorial defect
(d) Schottky defect
(e) Frankel defect

23. (a)

Wrought iron can neither be hardened nor tempered like steels.

24. (a)

Iron-carbon diagram and TTT curves are determine under equilibrium and non-equilibrium conditions respectively.

25. (c)

Cold shuts occur when two relatively cold streams of molten metal from different gates meet and do not fuse together properly during the casting process.

26. (d)

In atomization process, the molten metal is injected through a small orifice and the emerging liquid stream is broken into fine droplets by a jet of air, steam or inert gas. The fine droplets, when cooled form fine particles of varied shapes. The particle size formed depends on the size of the orifice, temperature of the metal, pressure or velocity of the atomizing gas stream etc. Atomization produces fine powders with spherical shape or smooth surface.

27. (d)

- Surface cracking and pipe defect are extrusion defects.
- Wavy edge or edge crack defects are rolling defects.

28. (b)

As bend radius, $R \geq 2t$; stretch factor, $k = 0.5$

So bend allowance, $L_b = \alpha(R + kt)$

$= 1\ (98 + 0.5 \times 4) = 100$ mm

29. (b)

- In one setting of rolls in a 3-high rolling mill, two reductions in thickness can be obtained.
- Rolling very thin strips of mild steel requires small diameter rolls.

30. (a)

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