CLASS TEST

S.No. : 01SK_ABCDEFG_21425

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CASTING+WELDING+FORMING

MECHANICAL ENGINEERING

Date of Test : 21/04/2025

ANSWER KEY ➤

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

DETAILED EXPLANATIONS

1. (c)

High corrosion resistance

5. (c)

Due to high chemical activity among all structural metals, except aluminium and magnesium, brazing can join almost all metals.

6. (a)

Given: Voltage = 20 V, Current = 155 A, Heat transfer efficiency = 0.85

Net heat supplied = $0.85 \times 20 \times 155 = 2635$ W

Travel speed, $v = 5$ mm/sec

Area of joint, $a = 10$ mm^2

Volume of base metal melted = $5 \times 10 = 50$ mm^3/sec

Heat required for melting = $50 \times 10 = 500$ J/sec = 500 W

$$\text{Melting efficiency} = \frac{\text{Heat requited for melting}}{\text{Net heat supplied}} \times 100\%$$

$$= \frac{500}{2635} \times 100 = 18.975\%$$

7. (b)

Given: Volume of casting = $(10)^3 = 1000$ cm^3

Surface area of casting = $6 \times 10^2 = 600$ cm^3

Time required to solidify, $T_s = r\left(\frac{V}{A}\right)^2$

$$T_s = 1.44 \times 10^5 \text{ sec/m}^2 \times \left(\frac{1000}{600}\text{ cm}\right)^2$$

$$= 1.44 \times 10 \text{ sec/cm}^2 \times 2.778 \text{ cm}^2 = 40 \text{ sec}$$

$T_s = 40$ sec

9. (a)

$$\text{Drawing ratio} = \frac{D_b}{D_p} = \frac{225}{100} = 2.25$$

11. (a)

$$\text{Dimension of wooden pattern} = 29 \times \left(1 + \frac{21}{1000}\right)\left(1 + \frac{13}{1000}\right) = 29.991 \text{ mm}$$

13. (d)

$$\frac{\text{Corner radius}}{\text{Shell diameter}} = \frac{r}{d} = \frac{1.8}{40}$$

As, $\frac{d}{r} > 20$

$$\text{Blank diameter} = \sqrt{d^2 + 4dh} = \sqrt{40^2 + 4 \times 40 \times 60} = 105.83 \text{ mm}$$

14. (b)

Combination die is similar to compound die except that here non cutting operations such as bending and forming are also included as part of operation.

16. (a)

$$\text{Length of contact, } L_p = R\sin\alpha = \sqrt{R\Delta h}$$

$$\Delta h = 2R(1 - \cos\alpha)$$

$$5 = 2 \times 150\ (1 - \cos\alpha)$$

$$\frac{5}{300} = 1 - \cos\alpha$$

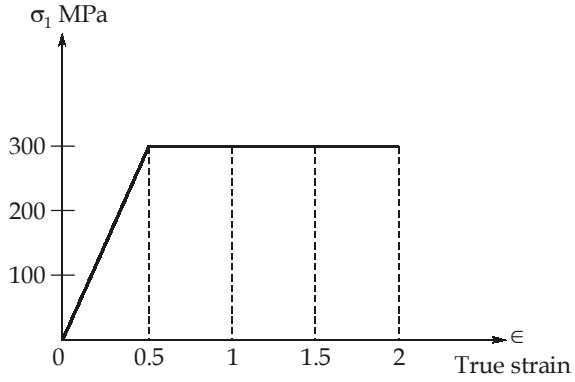
$$\Rightarrow \quad \alpha = 10.4753°$$

$$L_p = 150 \times \sin 10.4753° = 27.27 \text{ mm}$$

$$\text{Roll separating force, } F = \sigma_0 L_p \times b = 195 \times 27.27 \times 100$$

$$= 0.531 \text{ MN}$$

Ans. 27.5 mm, 0.531 MN



17. (d)

$$\text{Energy expanded} = \left(\frac{1}{2} \times 0.5 \times 300 + 300 \times 1.5\right) \times \frac{1\text{MN}}{\text{m}^2} \times \text{m}^3$$

$$= (75 + 450) \times 1000 \text{ kJ} = 525000 \text{ kJ}$$

18. (a)

$$\text{Extrusion load, } P = A_0\sigma_0 \ln\frac{A_0}{A_f} = \frac{\pi}{4} \times 50^2 \times 365 \times \ln\left(\frac{\frac{\pi}{4} \times 50^2}{\frac{\pi}{4} \times 42.5^2}\right)$$

$$= \frac{\pi}{4} \times 50^2 \times 365 \times 2\ln\left(\frac{50}{42.5}\right)$$

$$= 232946.7755 \text{ N} = 232.947 \text{ kN}$$

19. (c)

$$GF = \frac{mv^2/R}{mg} = \frac{v^2}{Rg},\ v = \frac{\pi DN}{60}$$

$$= \frac{\pi^2 D^2 N^2}{3600 \times Rg} = \frac{\pi^2 \times D^2 \times N^2 \times 2}{3600 \times D \times g} = \frac{\pi^2 \times D^2 \times N^2}{1800 \times g}$$

$$N = \sqrt{\frac{GF \times 1800 \times g}{\pi^2 D}} = \frac{30}{\pi}\sqrt{\frac{2g(GF)}{D}}$$

here D is inner diameter of mold for horizontal centrifugal casting,

$$N = \frac{30}{\pi}\sqrt{\frac{2 \times 9.81 \times 60}{0.5073}} = 460 \text{ rpm}$$

20. (c)

All three sum up to give resistance in resistance welding.

21. (b)

Large reduction or rolling using large diameter rolls leads to tensile stress on skin and compressive stress in bulk of metal.

22. (c)

$$\text{Volume of casting} = \frac{\pi}{4} \times (40)^2 \times 5 \text{ cm}^3$$

$$= 6283.185 \text{ cm}^3$$

$$\text{Extra volume needed} = 15\% \text{ of } 6283.185$$

Total volume of metal required = 7225.663 cm^3

$$\text{Mass of aluminium} = 7225.663 \times 2.7 \text{ gms}$$

$$= 19509.290 \text{ gms}$$

$$\text{Heat required} = 19509.260\ [389.3 + 0.88(800 - 25)]$$

$$= 19509.290\ (1071.3) \text{ J}$$

$$= 20900302.38 \text{ J} = 20.90 \text{ MJ}$$

23. (a)

For hot rolling $(\Delta h)_{max} = \mu^2 R$

$(\Delta h)_{max} = (0.5)^2 \times 225 = 56.25$ mm

For cold rolling, $(\Delta h)_{max} = (0.09)^2 \times 300 = 2.43$ mm

$$\text{Factor} = \frac{56.25}{2.43} = 23.148$$

24. (b)

$$\text{Sand density} = 1.6 \text{ g/cm}^3 = 0.0016 \text{ kg/cm}^3$$

$$\text{Volume of core} = \frac{20}{0.0016} = 12500 \text{ cm}^3$$

$$\text{Density of Al-Cu alloy} = 2.81 \text{ g/cm}^3 = 0.00281 \text{ kg/cm}^3$$

Upward force = Weight of displaced Al-Cu alloy
= 12500 × 0.00281 = 35.125 kg
Net upward force = Upward force – Weight of core
= (35.125 – 20) × 9.81 = 148.37 N ≈ 148.5 N

25. (b)
Melting factor in welding is defined as the proportional of the heat received at the work surface that is used for melting.

26. (c)
Electro gas welding, Electron beam welding, Laser beam welding are classified as fusion welding.

27. (c)
Increases flow stress: As strain rates increases, flow stress increases.

28. (b)

$$\text{Mean flow stress } (\bar{\sigma}_0) = \frac{k \in^n}{1+n}$$
$$k = 600 \text{ MPa}$$
$$n = 0.15$$
$$200 = \frac{600 \times \in^{0.15}}{1+0.15}$$
$$\in = 1.67 \times 10^{-3}$$
$$\sigma = 600\ (1.67 \times 10^{-3})^{0.15}$$
$$\text{True stress, } \sigma = 230 \text{ MPa}$$

29. (d)
Spring back in a sheet metal bending operation is due to elastic recovery of metal.

30. (c)
Power supplied = 0.7 × 0.65 × 22 × 135 = 1351.35 J
Powered required = 10.3 × 5 × AW
(where, AW = Area of weld in mm^2)
1351.35 = 10.3 × 5 × AW
Area of weld = 26.24 mm^2
Volume of weld = 26.24 × 5 = 131.2 mm^3/sec

$$\text{Area of filler wire} = \frac{\pi}{4} \times (3.5)^2 = 9.62 \text{ mm}^2$$

$$\text{Feed of filler wire (60\% volume of filler)} = \frac{0.6 \times 131.2}{9.62} = 8.18 \text{ mm/sec}$$

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