1. A pn junction is forward biased when the n side is more positive than the p side.

   ☐ True ☐ False

2. A half-wave rectifier's output never reverses direction.

   ☐ True ☐ False

3. The BJT stays in the active region as long as

   ☐ V_CE > 0 V

   ☐ V_BE > 0.7 V

   ☐ I_C > I_B

   ☐ V_CE > about 0.2 V

4. An n-channel MOSFET with V_t = 1.5 V and v_GS = 1.0 V conducts a small drain current set by the square law.

   ☐ True ☐ False

5. In the small-signal model, a DC supply rail becomes signal ground.

   ☐ True ☐ False

6. An inverting stage has R_in = 10 kΩ and R_f = 90 kΩ. What is β_fb?

   _____

7. A 1 µF coupling capacitor sees 10 kΩ. What is f_L, in Hz?

   _____ Hz

8. Ten times the diode current costs how much extra voltage (n = 1)?

   ☐ 120 mV

   ☐ 0.7 V

   ☐ 26 mV

   ☐ about 60 mV

9. Each bridge diode must survive a peak inverse voltage of about

   ☐ the ripple

   ☐ 0.7 V

   ☐ one secondary peak (17 V here)

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10. A bias divider has R1 = 47 kΩ to a 10 V supply and R2 = 10 kΩ to ground. What is V_B, in volts, ignoring base current?

    _____ V

1. **False**

   Forward bias puts the p side positive. With the n side positive the depletion region widens and the junction blocks.

2. **True**

   The diode blocks the negative half-cycles, so the load current only ever flows one way. It is DC in direction, though far from steady.

3. **V_CE > about 0.2 V**

   Saturation starts at about $V_{CE} = 0.2$ V, with both junctions forward biased. Checking $V_{CE} > 0$ lets a saturated transistor pass as an amplifier.

4. **False**

   $v_{GS} < V_t$, so no channel forms: the device is cut off. The square law applies only above threshold, in saturation.

5. **True**

   A constant voltage has no wiggle, so for the signal it behaves as a short to ground. The same holds for large coupling and bypass capacitors at signal frequency.

6. **0.1**

   $\beta_{fb} = \dfrac{10}{10 + 90} = 0.1$. The ideal gain is -9; with $A_{OL} = 10^5$ the loop gain is 10^4.

7. **15.9 Hz**

   $\dfrac{1}{2\pi \times 10^4 \times 10^{-6}} = 15.9$ Hz.

8. **about 60 mV**

   $\ln 10 \times V_T = 2.303 \times 26 = 59.9$ mV. This steepness is why the 0.7 V model works; with n = 2 it would be 120 mV.

9. **one secondary peak (17 V here)**

   The pair that is off sees one full secondary peak, $12\sqrt{2} = 17$ V. Rate the diodes above that.

10. **1.75 V**

    $10 \times \dfrac{10}{57} = 1.75$ V. Its Thévenin resistance is $47\,\text{k} \parallel 10\,\text{k} = 8.25\,\text{k}\Omega$.

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