

1. As shown on the right, six parameters of an ideal operational amplifier are listed. Circle the correct value for each parameter.

Differential gain	0	∞
Common mode gain	0	∞
Common mode rejection ratio	0	∞
Input impedance	0	∞
Output impedance	0	∞
Bandwidth	0	∞

2. () Refer to the circuit on the right for questions 2 to 5. The stage-1 gain is defined by $(V_3 - V_4) / (V_1 - V_2)$. If we want to set the first-stage gain to 5.7, what value should be chosen for R_1 ? (A) 100 K Ω , (B) 200 K Ω , (C) 330 K Ω , (D) 470 K Ω , (E) none of the above.

3. () The stage-2 gain is defined by $V_5 / (V_3 - V_4)$. What is the gain for stage 2? (A) -4.7, (B) -5.7, (C) -9.4, (D) -11.4, (E) none of the above.

4. () Stage 3 is a bandpass filter with a passing band between 1 Hz and 30 Hz. If we choose $C_5 = 2 \mu\text{F}$, what value should R_5 be set at? (A) 24 K Ω , (B) 33 K Ω , (C) 56 K Ω , (D) 80 K Ω , (E) none of the above.

5. () For stage 3, if choose $C_6 = 0.22 \mu\text{F}$, what value should R_6 be set at? (A) 24 K Ω , (B) 33 K Ω , (C) 56 K Ω , (D) 80 K Ω , (E) none of the above.

6. Draw lines to connect each of the 5 parameters to the appropriate threshold value. The mapping should be one-on-one. VF stands for ventricular fibrillation.

Let-go current	100 μA
Burns	1 mA
Perception level	10 mA
Macroshock VF	100 mA
Microshock VF	5 A

7. () Which of the following leads are not included the 12-lead ECG routinely used in the clinics nowadays? (A) standard leads, (B) unipolar leads, (C) augmented leads, (D) chest leads, (E) none of the above.

8. () An ectopic focus in an impaired ventricle is likely to cause (A) atrial fibrillation, (B) bundle branch block, (C) premature ventricular contraction, (D) ST segment elevation, (E) none of the above.

9. () Which of the following ranges of arterial oxygen saturation is considered normal at the sea level? (A) 60-70%, (B) 70-80%, (C) 80-90%, (D) 90-100%, (E) none of the above.

10. () Comparing oximetry and pulse oximetry, which of the following statements is incorrect? (A) Oximetry measures the absolute oxygen concentration, whereas pulse oximetry measures the relative oxygen saturation in the arterial blood, (B) Oximetry is typically done *in vitro*, whereas pulse oximetry is typically done *in vivo*. (C) An oximeter is factory-calibrated, whereas a pulse oximeter requires constant calibrations. (D) An oximeter is usually much more expensive than a pulse oximeter. (E) none of the above.

