KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF SCIENCE

B.Sc Comp. Sci./ B.Sc Physics/B.Sc Met. & Cli. Science, mid-semester Examinations, 2013

SECOND YEAR

The circled alternative answer is not always the right answer. please solve them yourself.

CSM 251 / PHY 251 Electronics I

Index number.....

7th November 2013 TIME : 40 minutes

Answer all questions

- **Circle the correct answer on the question paper**
- **Shade the correct answer on the scannable sheet.**

1. Suppose that we add some arsenic atoms to Germanium, which of the following statements is false:
   A. The crystal structure will remain unchanged
   B. The electronic structure will change
   (C) One electron that can affect conductivity has been added per replacement atom.
   D. The crystal structure will change

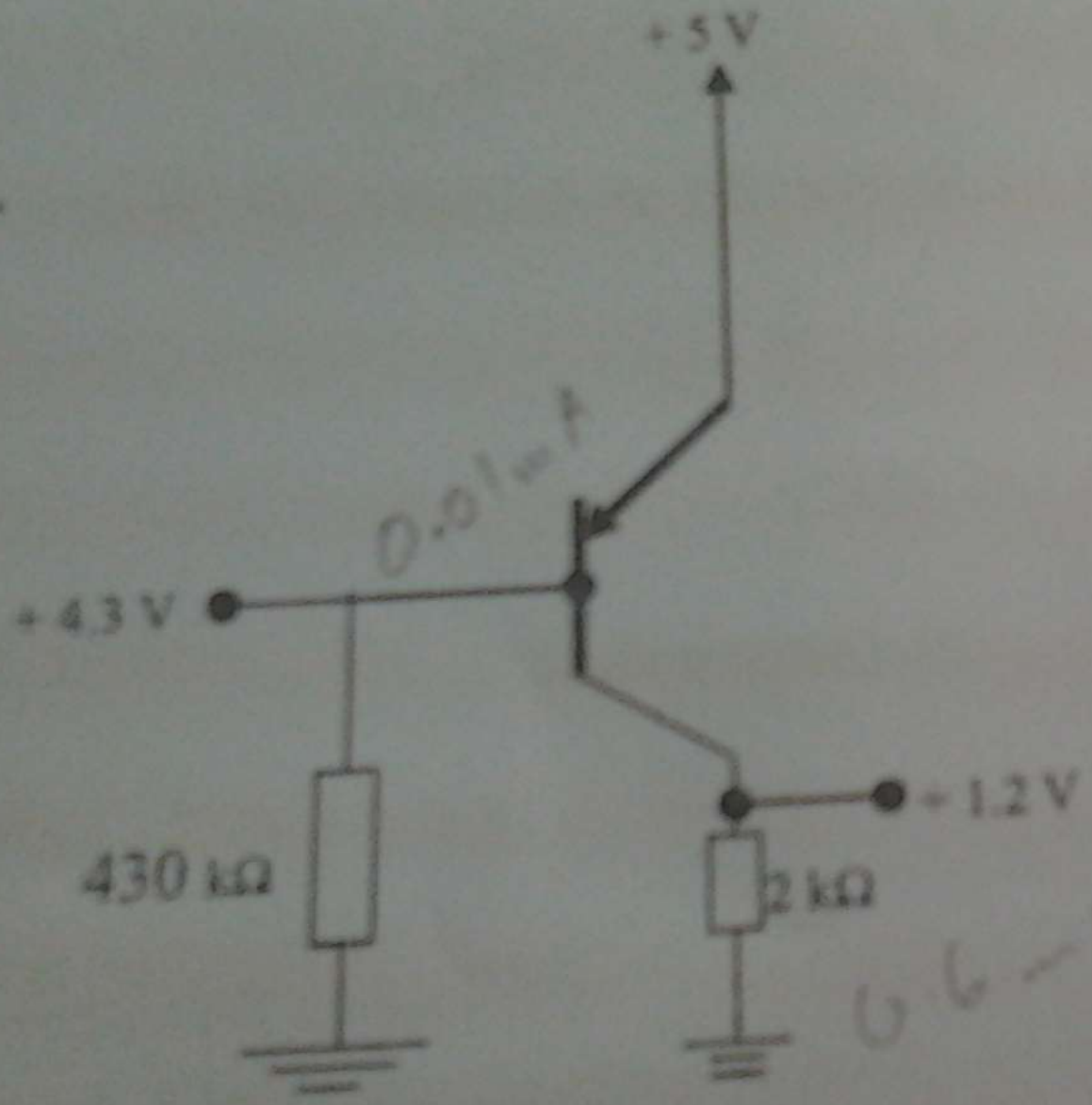
2. Consider the following statement – electrons from the valence band are easily promoted to the acceptor level leaving behind holes that are very effective in carrying charge.- Which type of semiconductor is the above statement referring to?
   (A) P-type semiconductor
   B. N-type semiconductor
   C. P-N junction
   D. None of the above

3. Which of the following statements is false for a P-type semiconductor?
   A. It is positively charged
   (B) It is electrically neutral
   C. Majority charge carriers are holes and minority carriers are electrons
   D. It is formed by a trivalent impurity

4. A semiconductor material has a _____ temperature coefficient of resistance, which means that as temperature increases its resistance _____
   A. Positive, increase
   B. Positive, decrease
   C. Negative, increase
   (D) Negative, decrease

Measurements on the circuit in question 20, produce labeled voltages
value of β for this transistor.

20.



A. 98
B. 60
C. 100
D. 101

Analyse the circuit in figure 3 and use it to answer question 16 - 19. Take $\beta = 100$.

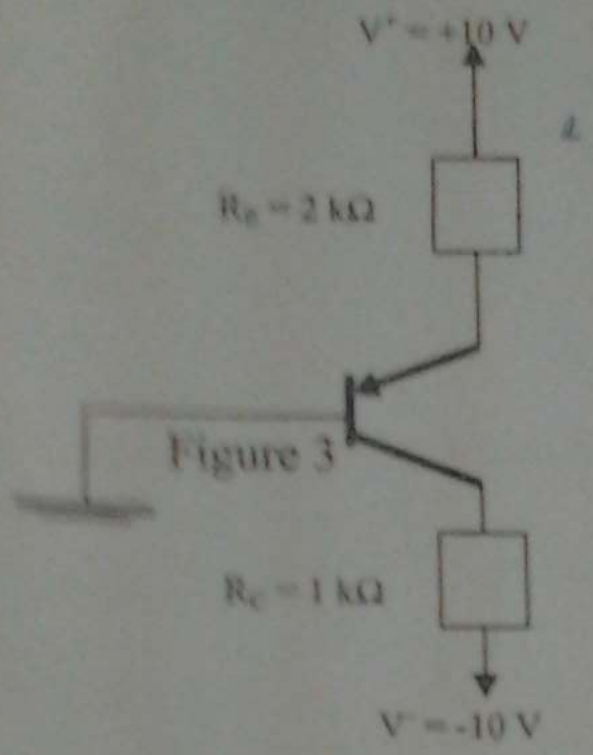


Figure 3

16. What is the value of the current flowing through the collector?
   A. 4.65 mA
   B. 4.67 mA
   C. 4.66 mA
   D. 4.66 MA

17. What is the value of the base current?
   A. 0.05 mA
   B. mA
   C. 0.03 mA
   D. 0.02 mA

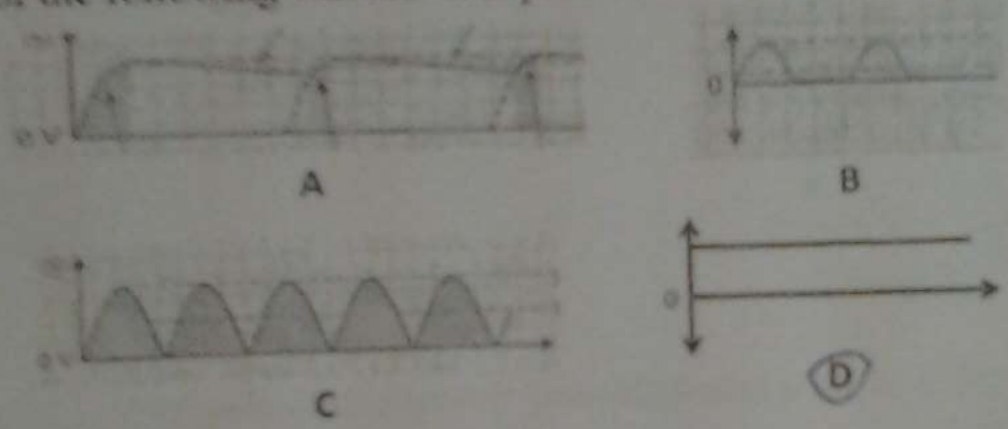
18. What is the value of the emitter current?
   A. 4.6 mA
   B. 4.71 mA
   C. 4.70 mA
   D. 4.4 mA

19. What voltage would you expect at the emitter?
   A. 5.4 V
   B. 5.5 V
   C. 5.6 V
   D. 5.7 V

9. The circuit component labeled 'T_1' is responsible for
   A. Reducing the current in the circuit to predetermined values
   (B) Transforming the voltage to predetermined values
   C. Reducing the amplitude of the input voltage to predetermined values
   D. Setting the value of the current flowing in the circuit

10. The function of the capacitor in the circuit is
   A. To store charges
   B. To act as a filter
   C. To replace the EMF
   (D) To regulate the voltage

11. Which of the following waveform is produced at the output of the bridge rectifier?



12. The arrowhead on the transistor symbol points in the direction of
   A. Electron flow in the emitter region.
   B. Minority carrier flow in the emitter region.
   C. Majority carrier flow in the remitter region.
   (D) Conventional current flow in the emitter region

13. A BJT is in the saturation region if:
   A. Base-emitter junction is reverse-biased and base-collector junction is forward-biased
   B. Both junctions are reverse-biased
   (C) Both junctions are forward-biased
   D. Base-emitter junction is forward-biased and base-collector junction is reverse-biased

14. β is the symbol for the
   A. Common emitter current gain
   (B) Common collector current gain
   C. Common base current gain
   D. None of the above

15. Transistors (BJT) of certain type are specified to have β in range 50 to 150. Find the range of their α values.
   A. 0.97 to 0.993
   (B) 0.98 to 0.993
   C. 0.0196 to 6.6×10^{-3}

Use figure 1 below to answer questions 5 and 6

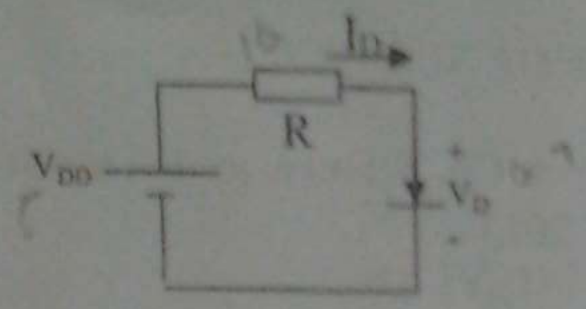


Figure 1

5. Find V_D for the case $V_{DD} = 5$ V and $R = 10$ kΩ. Assume that the diode has a voltage of 0.7 V at 1 mA current and the voltage changes by 0.1 V per decade of current change. Use iterative analysis.

A. 0.666 V
B. 0.665 V
C. 0.674 V
D. 0.663 V

6. Estimate I_D using the piece-wise linear model with $V_{DO} = 0.65$ V and $r_D = 20\ \Omega$.

A. 0.434 mA
B. 0.344 mA
C. 0.334 mA
D. 0.333 mA

Use figure 2 to answer questions 7 to 11

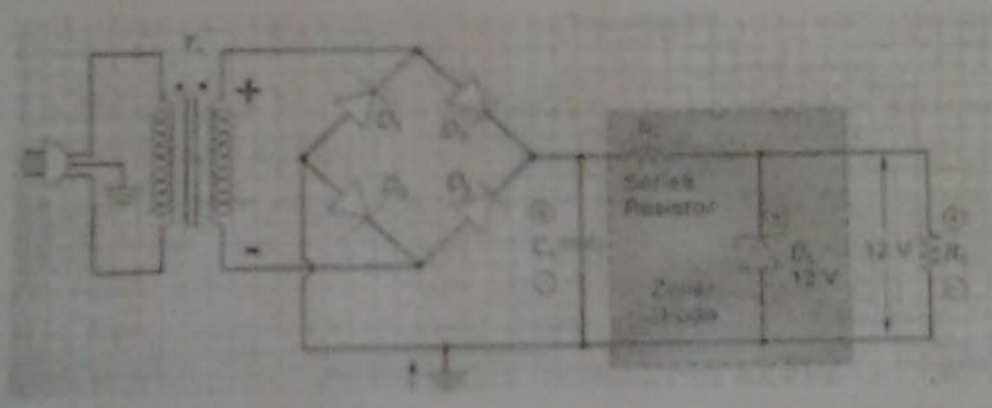


Figure 2

7. If the bridge rectifier is biased with the polarity shown in the figure, which of the diodes would be turned on?

A. D1 and D2
B. D3 and D2
C. D1 and D3
D. D4 and D1

8. The rectifier above is called a full wave rectifier because

A. It uses a quarter of each half of the input sinusoid
B. It uses half of the input sinusoid
C. It uses both halves of the input sinusoid
D. Because it uses alternate halves of the input sinusoid

4. During the formation of a P-N junction the n side of the junction contains a net positive charge. Similarly in the p material, there will be a region close to the junction that is depleted of holes and contains a net negative charge. These charges are due to :

a). The diffusion current
b). The drift current
c). bound charges associated with donor and acceptor atoms
d). doping in the semiconductor

5. Which of the following statements is false for a P-type semiconductor?

a). It is positively charged
b). It is electrically neutral
c). Majority charge carriers are holes and minority carriers are electrons
d). It is formed by a trivalent impurity

6.

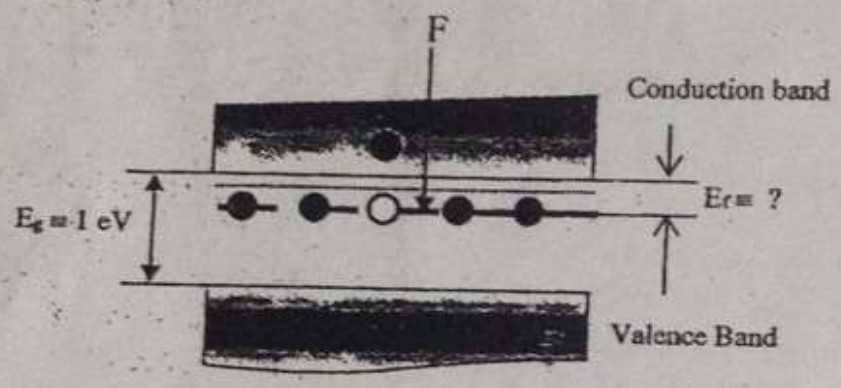


Figure 1

Consider the silicon semiconductor shown in Figure 1 above. Which of the following elements is responsible for creating the energy level marked 'F'?

a). Indium
b) Boron
c). Germanium
d). Arsenic

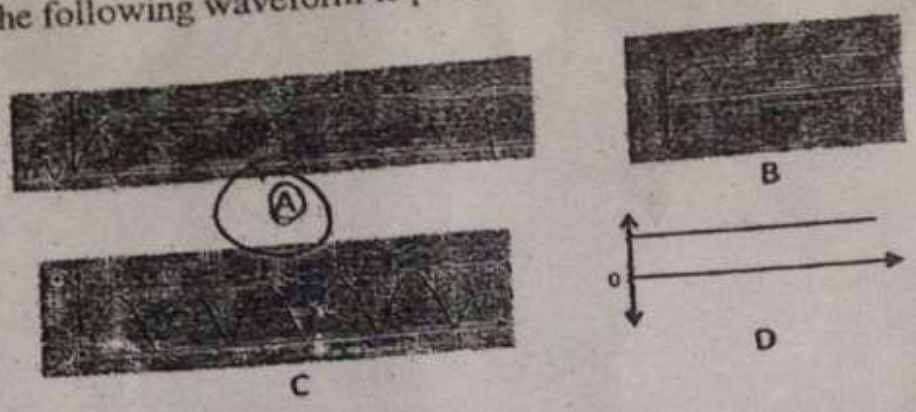
7. The energy gap represented by E_f in figure 1 has the value

a). 0.01 eV
b). 0.001eV
c). 0.025 eV
d). 0.0025 eV

8. The unidirectional-current-flow property makes the diode useful in the design of

a. P-n junction diodes
b. Diode valves
c. Rectifier circuits
d. Semiconductor diodes

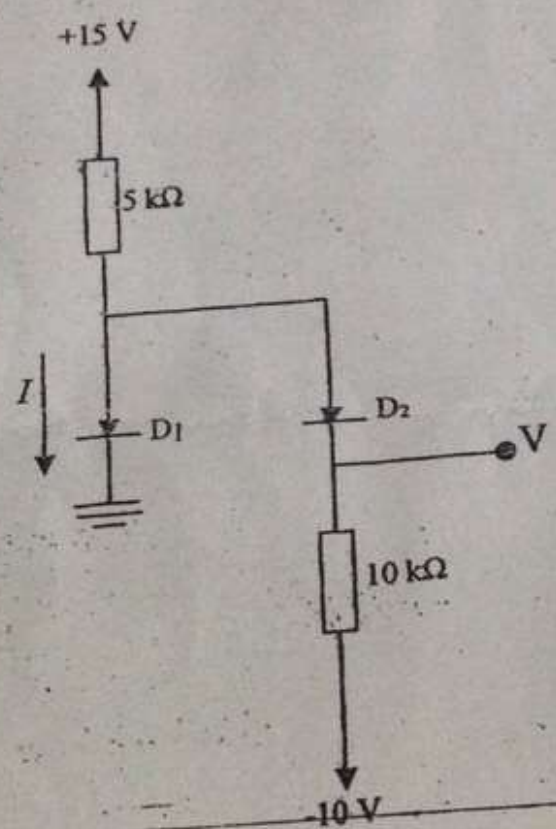
15. Which of the following waveform is produced at the output of the capacitor?



Theory : Answer this section in your answer booklets

Assuming that the diodes are ideal, find the value of the labeled current. (State any assumptions made)

16



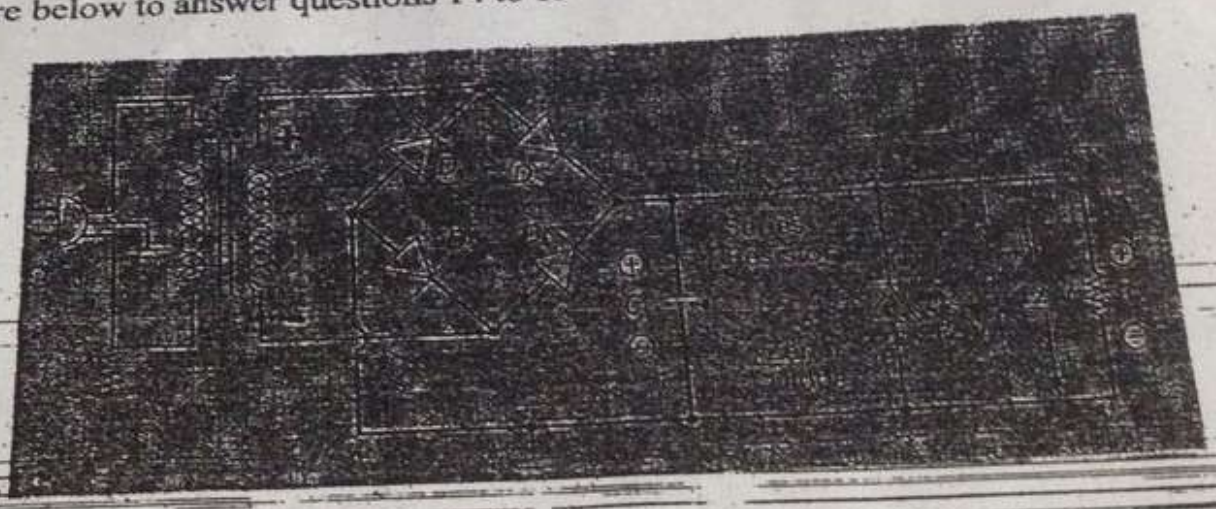
c. When the voltage drop across a fully conducting diode exceeds 0.7 V
d. None of the above.

11. The unidirectional-current-flow property makes the diode useful in the design of
a. P-n junction diodes
b. Diode valves
c. Rectifier circuits
d. Semiconductor diodes

12. Which of the foliowing statements is not a characteristic of an ideal diode?
a). If a positive current is applied to the diode, a zero voltage drop appears across the diode.
b). If a negative voltage is applied to the diode, no current flows and the diode behaves as an open circuit.
c). The breakdown region is entered when the magnitude of the reverse current exceeds a threshold value specific to the particular diode, called the breakdown voltage.
d). None of the above

13. In the forward direction, the ideal diode conducts any current forced by the external circuit while displaying a
a. Zero voltage drop
b. Negative voltage drop
c. Positive voltage drop
d. A 0.7 V voltage drop

Use the figure below to answer questions 14 to 15



14. The function of the zener diode is to ensure that
A. A constant current is delivered at the output of the circuit irrespective of voltage fluctuations in the mains supply
B. A constant voltage is delivered at the output irrespective of current fluctuations in the circuit
C. The ripples in the input sinusoid are reduced
D. The fuse does not blow up

Mid-Semester Examination

SECOND YEAR

PHY 251 Electronics I

Index number.....

TIME : 1 Hour

Answer all questions

- **Circle the correct answer on the question paper**

1. Which of the following statements is false?
   a). When atoms are packed closely together to form a crystal, the allowable energy levels broaden into bands of energy.
   b). Between adjacent energy bands are gaps or forbidden regions where there are no allowable energy levels
   c). The presence of electrons in the conduction band is crucial to the conduction process.
   d). At 0 K, the electrons in the valence band are free to move under an applied electric field

2. Suppose that we add some arsenic atoms to Germanium, which of the following statements is false:
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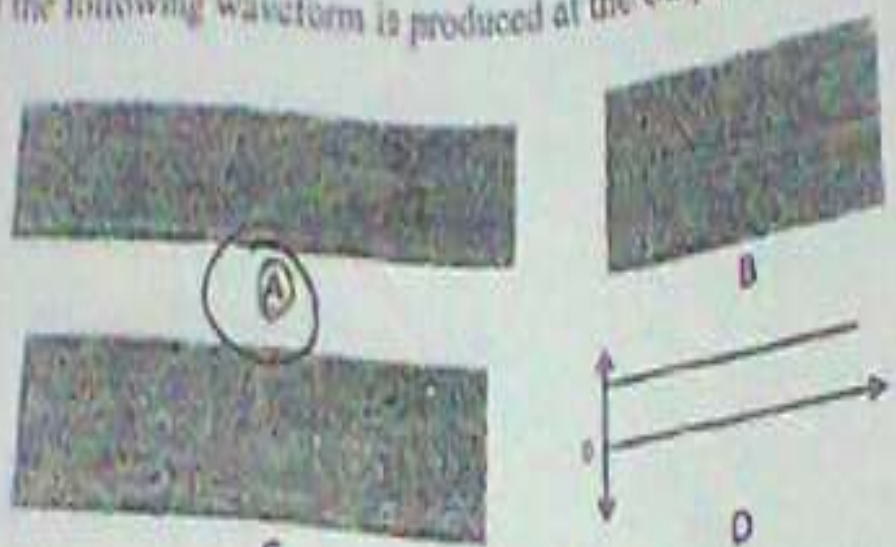

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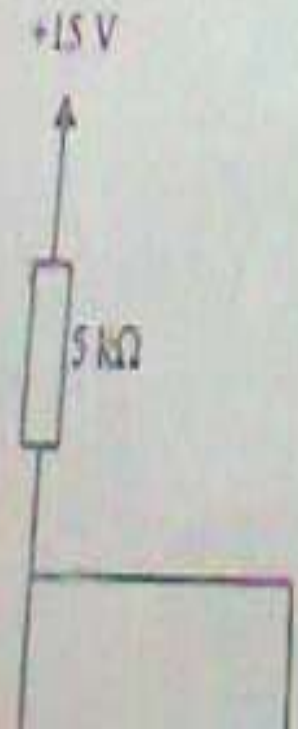
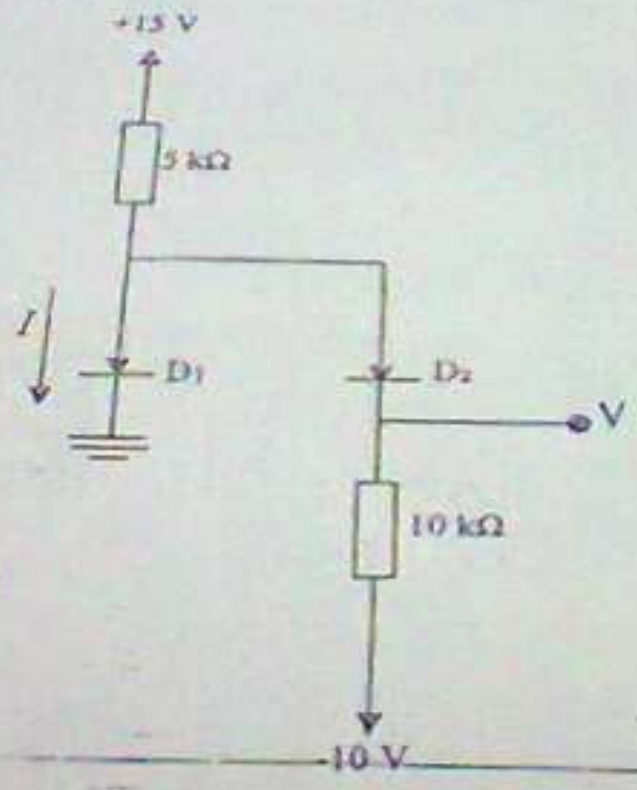


c

Theory : Answer this section in your answer booklets

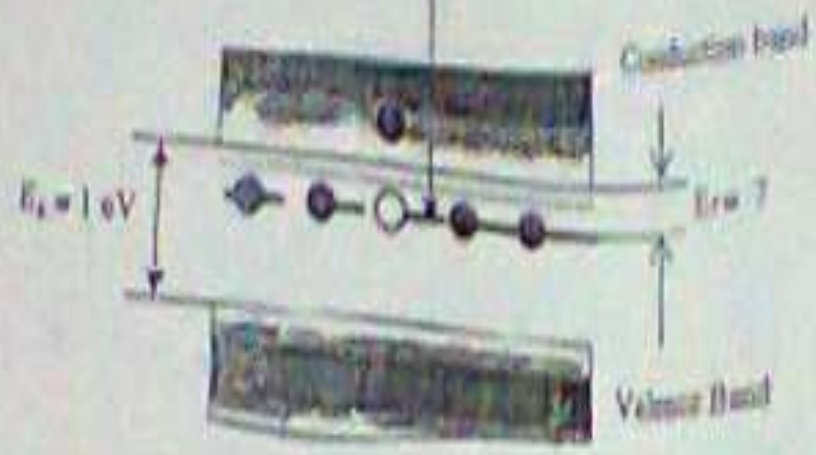
Assuming that the diodes are ideal, find the value of the labeled current. (State any assumptions made)

10



d). It is formed by a trivalent impurity

6.



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