

1. a) $A = 0.12 \text{ m} \cdot 0.080 \text{ m} = 9.6 \cdot 10^{-3} \text{ m}^2$ $\Phi = A \cdot B = 9.6 \cdot 10^{-3} \text{ m}^2 \cdot 0.34 \text{ T} = \underline{3.3 \cdot 10^{-3} \text{ Tm}^2}$
- b) $A = 0.070 \text{ m} \cdot 0.080 \text{ m} = 5.6 \cdot 10^{-3} \text{ m}^2$ $\Phi = A \cdot B = 5.6 \cdot 10^{-3} \text{ m}^2 \cdot 0.34 \text{ T} = \underline{1.9 \cdot 10^{-3} \text{ Tm}^2}$
- c) The magnetic field lines are parallel to the face of the loop of wire. Thus, A through the loop of wire is zero, and $\Phi = 0$.

$$2. \quad B = \frac{\Phi}{A} = \frac{2.53 \cdot 10^{-5} \text{ Tm}^2}{76 \cdot 10^{-4} \text{ m}^2} = \underline{3.3 \text{ mT}}$$

3. a) No. No change in the magnetic field, no change in the area of the loop of wire.
- b) Yes. The magnetic field changes while the magnet passes through the loop of wire.
- c) Yes. While the loop of wire rotates the area perpendicular to the loop of wire changes.
- d) No. No change in the magnetic field, no change in the area of the loop of wire.
- e) Yes. The magnetic field changes while the magnet rotates.
- f) No. No change in the magnetic field, no change in the area of the loop of wire.

$$4. \quad \text{a) } U_{\text{ind}} = -n \cdot \frac{\Delta\Phi}{\Delta t} = -n \cdot B \cdot \frac{\Delta A}{\Delta t} = -1 \cdot 66.5 \cdot 10^{-3} \text{ T} \cdot \frac{4.5 \cdot 10^{-4} \text{ m}^2 - 2.5 \cdot 10^{-4} \text{ m}^2}{0.22 \text{ s}} = -6.0 \cdot 10^{-5} \text{ V}$$

$$|U_{\text{ind}}| = \underline{6.0 \cdot 10^{-5} \text{ V}}$$

$$\text{b) } U_{\text{ind}} = -n \cdot \frac{\Delta\Phi}{\Delta t} = -n \cdot A \cdot \frac{\Delta B}{\Delta t} = -1 \cdot 4.5 \cdot 10^{-4} \text{ m}^2 \cdot \frac{66.5 \cdot 10^{-3} \text{ T}}{0.020 \text{ s}} = -1.5 \cdot 10^{-3} \text{ V}$$

$$|U_{\text{ind}}| = \underline{1.5 \text{ mV}}$$

$$5. \quad \cos \alpha = \frac{\text{Adjacent}}{\text{Hypotenuse}} \quad \Rightarrow \quad \text{Adjacent} = \cos \alpha \cdot \text{Hypotenuse} = \cos (45^\circ) \cdot 37.5 \text{ cm} = 26.5 \text{ cm}$$

$$A = 26.5 \text{ cm} \cdot 37.5 \text{ cm} = 994.4 \text{ cm}^2 = 9.94 \cdot 10^{-2} \text{ m}^2$$

$$\Phi = B \cdot A = 25 \cdot 10^{-3} \text{ T} \cdot 9.94 \cdot 10^{-2} \text{ m}^2 = \underline{2.49 \cdot 10^{-3} \text{ Tm}^2}$$

$$6. \quad U_1 = -\frac{\Delta\Phi}{\Delta t} = \frac{0}{3.0 \text{ s}} = \underline{0}$$

$$U_3 = -\frac{\Delta\Phi}{\Delta t} = \frac{0}{4.0 \text{ s}} = \underline{0}$$

$$U_5 = -\frac{\Delta\Phi}{\Delta t} = \frac{0}{2.0 \text{ s}} = \underline{0}$$

$$U_7 = -\frac{\Delta\Phi}{\Delta t} = -\frac{4.0 \cdot 10^{-3} \text{ Tm}^2}{3.0 \text{ s}} = \underline{-1.3 \text{ mV}}$$

$$U_9 = -\frac{\Delta\Phi}{\Delta t} = -\frac{-7.0 \cdot 10^{-3} \text{ Tm}^2}{2.0 \text{ s}} = \underline{3.5 \text{ mV}}$$

$$U_{11} = -\frac{\Delta\Phi}{\Delta t} = \frac{0}{3.0 \text{ s}} = \underline{0}$$

$$U_2 = -\frac{\Delta\Phi}{\Delta t} = \frac{3.0 \cdot 10^{-3} \text{ Tm}^2}{4.0 \text{ s}} = \underline{-0.75 \text{ mV}}$$

$$U_4 = -\frac{\Delta\Phi}{\Delta t} = -\frac{-3.0 \cdot 10^{-3} \text{ Tm}^2}{2.0 \text{ s}} = \underline{1.5 \text{ mV}}$$

$$U_6 = -\frac{\Delta\Phi}{\Delta t} = -\frac{6.0 \cdot 10^{-3} \text{ Tm}^2}{2.0 \text{ s}} = \underline{-3.0 \text{ mV}}$$

$$U_8 = -\frac{\Delta\Phi}{\Delta t} = \frac{0}{3.0 \text{ s}} = \underline{0}$$

$$U_{10} = -\frac{\Delta\Phi}{\Delta t} = -\frac{1.0 \cdot 10^{-3} \text{ Tm}^2}{2.0 \text{ s}} = \underline{-0.50 \text{ mV}}$$