Quiz 4 solutions are in order of the questions for version 1.

(1). Correct answer is D The y-component of the force is just $ILB\sin\theta$ where θ is the angle between the field and the current direction. Here this angle is 25^0 and so

$$F_y = (2)(.3)(1.2)\cos(25) = .65N$$

By the right hand rule, this is in the positive $\hat{j}$ direction.

(2). Correct answer is C

The torque is the current times the area times the field times θ where θ is the angle between the field and the normal to the loop. Hence torque equals

$$\sin(25)(.12)(1.2)(2) = .12$$

(3). Correct answer is A

The centripetal acceleration is v^2/R. For a particle in a magnetic field, $v = qBR/m$. This gives

$$a = \left(\frac{qBR}{m}\right)^2 /R = \frac{(2\times 1.6\times 10^{-16})^2(.5)^2(.4)}{(6.68\times 10^{-27})^2}$$

(4). Correct answer is B

The induced voltage is given by $vBL\sin\theta$. The angle here is 40^o and hence we get

$$\Delta V = (20)(5\times 10^{-5})(1.2)\sin(40) = .77mV$$

(5). Correct answer is D

The induced electromotive force equals the rate of change of the magnetic flux. Here, the flux change is

$$\frac{\Delta\Phi_M}{\Delta t} = .20^2(.9-.3)/.06 = .4V$$

This gives rise to a 40 mA current. Since the field into the board is decreasing, the current will flow in the direction needed to create more field into the board; this is the clockwise direction, hence the current goes from b to a

(6). Correct answer is B

The flux is $B\times N_{turns}\times A\times\cos\theta$, where the angle is between the coil normal and the magnetic field. giving

$$.8\times 4\times .09\cos(30) = .25$$

(7). Correct answer is D

All the choices other than D results in a change of flux through the coil.

(8). Correct answer is B

When the switch is first thrown, all the battery voltage appears across the inductor. This voltage than decays in time according to the general formula

$$V(t) = V_0 e^{-t/\tau}$$

where the time constant for this R-L circuit is $\tau = L/R = 2.5$ secs. Therefore, the voltage equals 24 when $24 = 60e^{-t/2.5}$ which can be solved to find $t = 2.3s$.

(9). Correct answer is C

Since $\vec{B}$ is parallel to the velocity vector, there is no induced voltage and no current,

(10). Correct answer is A

The minus sign is because induction always acts to oppose the change in flux. None of the other choices are always correct.