A.

1. $\forall x(\cancel{\exists x}Vx \to Thx)$

2. $\forall x(Txi \to \forall y(Vy \to Txy))$

3. $\forall x(Txi \to \exists y \forall z Tyz)$

4. $\forall x(Kx \to x=i)$ (does this mean that Ingmar knows the combination to the safe? if so then it should be $\forall x(Kx \to x=i) \land Ki$ or $\forall x(Kx \leftrightarrow x=i)$.)

5. $\forall x(x=h \leftrightarrow tih)$ or $\forall x((x=h \to tih) \land (\neg x=h \to \neg tih))$

Because they are equivalent

6. $\exists x(Kx \land \forall y(Ky \to x=y) \land Vx)$

or $\exists x Kx \land \forall x \forall y((Kx \land Ky) \to x=y) \land \forall x(Kx \to Vx)$

7. $\exists x(Kx \land \forall y(Ky \to x=y) \land \neg Sx)$

though it perhaps should be an outer negation (the person does not exist at all)

B

1. $\forall x(Cx \to Bx)$

2. $\neg \exists x Wx$

3. $\exists x \exists y((Cx \land Cy \land \neg x = y)$

4. $\exists x \exists y(Ox \land Oy \land Jx \land Jy \land \neg x = y)$

5. $\forall x \forall y \forall z(((Ox \land Oy \land Oz \land Jx \land Jy \land Jz) \to$
$(x = y \lor x = z \lor y = z))$

6. $\exists x \exists y(Bx \land By \land Jx \land Jy \land \neg x = y \land \forall z((Bz \land Jz) \to (x = z \lor y =$

~~4~~ 7. $\exists x \exists y \exists z \exists x_1(Dx \land Dy \land Dz \land Dx_1 \land \neg x = y \land \neg x = z \land$
$\neg x = x_1 \land \neg y = z \land \neg y = x_1 \land \neg z = x_1$
$\land \forall y_1(Dy_1 \to (x = y_1 \lor y = y_1 \lor z = y_1 \lor$
$x_1 = y_1)))$

8. $\exists x(Dx \land Cx \land \forall y((Dy \land Cy) \to x = y) \land Bx)$

9. ~~$\forall x(((Ox \land Jx) \lor Mx) \to Wx)$~~

$\forall x((Ox \land Jx) \to Wx) \land \exists x(Mx \land \forall y(My \to x = y) \land Wx)$

10. $\exists x(Dx \land Cx \land \forall y((Dy \land Cy) \to x = y) \land Wx) \to \exists x(Wx \land \forall y($
$Wy \to x = y))$

11. $\exists x(Mx \wedge \forall y(My \to x=y) \wedge \neg Jx)$

12. $\exists x((Dx \wedge Cx) \wedge \forall y((Dy \wedge Cy) \to x=y) \wedge$
$\exists y(My \wedge \forall z(Mz \to y=z) \wedge \neg x=y))$

or:
$\exists x \exists y(Dx \wedge Cx \wedge \forall z(Dz \wedge Cz \to x=z) \wedge My \wedge \forall z(Mz \to y=z)$
$\wedge \neg x=y))$

c.

1. $\exists x \exists y \exists z(Hx \wedge Hy \wedge Hz \wedge \neg x=y \wedge \neg x=z \wedge$
$\neg y=z)$

2. $\exists x \exists y \exists z(\neg x=y \wedge \neg x=z \wedge \neg y=z)$

3. $\exists x \exists y(Hx \wedge Hy \wedge Bx \wedge By \wedge \neg x=y)$

4. $\exists x \exists y \exists z(Hx \wedge Hy \wedge Hz \wedge Bx \wedge By \wedge Bz \wedge$
$\neg x=y \wedge \neg y=z \wedge \neg x=z \wedge \forall x_1((Hx_1 \wedge Bx_1)$
$\to (x_1=x \vee x_1=y \vee x_1=z)))$

5. $\exists x(Wx \wedge Bx \quad \forall y((Wy \wedge By) \to x=y))$

6. $\exists x(Px \wedge \forall y(Py \to x=y) \wedge Wx \wedge Hx)$

7. $\exists x(Bx \wedge \forall y(By \to x=y) \wedge \neg Hx)$

8. $\exists x(Hx \wedge Bx \wedge \forall y((Hy \wedge By) \to x=y) \wedge \neg Wx)$