

5.

a) $\forall \Box (-w \vee \exists \bigcirc \exists \blacklozenge b) \wedge \forall \Box (-g \vee \forall \bigcirc \forall \Box -b)$

b) $\forall \Box (-r \vee \forall \bigcirc (r \vee o \vee g))$

c) $\forall \Box (-w \vee \forall \bigcirc \forall \blacklozenge -w) \wedge \forall \Box (-r \vee \forall \bigcirc \forall \blacklozenge -r) \wedge \forall \Box (-g \vee \forall \bigcirc \forall \blacklozenge -g) \vee \forall \Box (-b \vee \forall \bigcirc \forall \blacklozenge -b)$

d) $\forall \Box (-w \vee \exists \bigcirc (b \vee (\forall \bigcirc (-b \vee \forall \Box -b) \vee \exists \bigcirc w)))$

e) $\forall \Box (-g \vee \forall \bigcirc \forall \blacklozenge (-g \vee \forall \bigcirc (g \vee \forall \bigcirc \forall \Box -g)))$