Practice: QL and QL$^{=}$

Universe of Discourse **D** = persons; Lexicon:

a = Locke	F = is a philosopher	L = … likes …
b = Berkeley	G = is empiricist	K = … knows …
c = Hume	H = is an atheist	R = … prefers … to …

1. Every philosopher who knows Locke likes him.
   $\forall x((Fx \,\&\, Kxa) \supset Lxa)$

2. There is an empiricist philosopher who is not an atheist.
   $\exists x(Fx \,\&\, Gx \,\&\, \sim Hx)$

3. Every empiricist philosopher likes Locke.
   $\forall x(Fx \,\&\, Gx) \supset Lxa$

4. There is nobody who does not prefer Hume to Berkeley.
   $\sim\exists x(\sim Rxcb)$

5. Every atheist who knows Hume is not liked by Berkeley and Locke.
   $\forall x(Hx \,\&\, Kxc) \supset (\sim Lbx \,\&\, \sim Lax)$ **or** $\forall x(Hx \,\&\, Kxc) \supset \sim(Lbx \vee Lax)$

6. $\forall x(Fx \,\&\, Rxba) \supset Lcx)$
   Every philosopher who prefers Berkeley to Locke is not liked by Hume.

7. $\exists x\forall y(Fx \,\&\, (Hx \vee Kxc) \,\&\, Rxyb)$
   There is an empiricist philosopher who is either an atheist or knows Hume and prefers anyone to Berkeley.

8. $\exists x(Fx \,\&\, \forall y(Hy \supset Lxy))$
   Some philosophers love every atheist.

9. $\sim\exists x(Gx \,\&\, \exists y(Hy \,\&\, Lxy)) \supset \forall z((Fx \,\&\, \sim Kxa) \supset Rzbc)$
   If there is no empiricist who likes any atheist, then all philosophers who do not know Locke prefer Berkely to Hume.

10. $\sim\forall x(Fx \,\&\, (\exists yLxy \,\&\, Gy)) \supset \forall z((Hz \,\&\, Lzx) \supset Kxz)$
    Not every philosopher who likes an empiricist knows any atheist who likes him/her.

11. Only Hume prefers Locke to Berkeley.
Rhab & ∀*x*(*Rxab* ⊃ *x* = *h*) **or** *Rhab* & ∀*x*(~*x* = *h* ⊃ ~*Rxab*)

12. Everybody except Locke knows either Berkeley or Hume.
∀*x*(*Kxb* ∨ *Kxc*) & ~*x* = *a*)

13. Everybody who likes Hume likes no one else.
∀*x*(*Lxc* ⊃ ~∃*y*(*Lxy* & ~*x* = *c*)

14. Hume is the only empirist and atheist philosopher.
Fc & *Gc* & *Hc* & ∀*x*((*Fx* & *Gx* & *Hx*) ⊃ *x* = *c*)

15. The most known philosopher is an empiricist.
∃*x*(([*Fx* & ∀*y*((*Fy* & ~*y* = *x*) ⊃ *Kyx*)] & ∀*z*([*Fz* & ∀*y*((*Fz* & ~*z* = *y*) ⊃ *Kzy*)]
⊃ *y* = *x*)) & *Gx*)

16. ∃*x*(*Kbx* & ~(*x* = *a* & *x* = *c*))
Berkeley knows someone but neither Locke nor Hume.

17. ~*c* = *b* ⊃ ∃*x*∃*y*(K*xa* & K*ya*) & ~*x* = *y*)
If Hume is not Berkeley, then at least two persons know Locke.

18. ∀*x*(*Lxc* ⊃ ~∃*y*(L*xy* & ~*y* = *c*)
Everybody only likes Hume.

19. ∃*x*((*Fx* & *Gx* & *Hx*) & ∀*y*(*Fy* & *Gy* & *Hy*) ⊃ *y* = *x*)
Exactly one philosopher is an empirist and an atheist.

20. ∃*x*(*Fx* & *Gx*) & ∀*y*(*Fx* & *Gx*) ⊃ *x* = *y*)) & (*Lcx* ⊃ *Hx*)
Hume likes the empiricist philosopher only if he is an atheist.

21. ∃*x*∃*y*∃*z*(((*Fx* & *Gx*) & (*Fy* & *Gy*) & (*Fz* & *Gz*) & (~*x* = *y* & ~*x* = *z* & ~*y* = *z*))
& ∀*w*((*Fw* & *Gw*) ⊃ (*w* = *x* ∨ *w* = *y* ∨ *w* = *z*)))
There are exactly three empiricist philosophers.