(a)

(b)

(c)

(d)

(e)
Acid in solution:

Mechanism:
(a) acid in solution:

![Diagram of acid in solution](image)

(b) mechanism:

![Diagram of mechanism](image)

the other resonance contributor can be used
compound $Q$
(after deprotonation)
(b) This is the only 3° carbocation possible, and it is also a resonance-stabilized allylic cation, and that combination is unique among the possible protonation reaction intermediates.

(c) Among the other three protonation reactions, there is one that makes a 2° allylic cation, while the other two make non-stabilized 2° cations, so the 2° allylic one is predicted to be next fastest to form.