95 ideas on Thomas Kühn's Philosophy of Science

1. The essential tension between tradition and innovation
2. Kuhn focused on the apparent paradox that, on the one hand, normal science is a highly convergent activity that is based upon a settled consensus, …
3. … and, on the other hand, the ultimate effect of this tradition-bound activity has invariably been to change the tradition.
4. Without the possibilities of divergent thought, fundamental innovation would be precluded.
5. But without a strong emphasis on convergent thought, science would become a mess due to continuous theory changes.
6. So, both convergent and divergent thought are necessary for the development of science.
7. Kuhn focused on the relation between different theoretical stages within the same discipline.
8. But what about interdisciplinary research?
9. In normal science, the characteristic problems are almost always repetitions with minor modifications of problems that have previously been undertaken and partially resolved.
10. It is the stable, focused effort to investigate in detail each question that a paradigm presents that ensures that eventually the holes and limits of the paradigm will be discovered.
11. How can the immediate similarity relations relevant to the identification of an empirical concepts referents and non-referents be learned by ostension?
12. The learning of empirical concepts occurs in a "metaphor-like process," …
13. … in which exemplary elements of the extension of the concept to be learned are juxtaposed, …
14. … and this juxtaposition of examples calls forth the similarities upon which the determination of reference depends.
15. The parallel to the workings of metaphors consist in the fact such juxtaposition, too, …
16. … neither presupposes nor supplies a list of the respects in which the subjects juxtaposed by metaphor are similar.
17. On the contrary, it is sometimes (perhaps always) revealing to view metaphor as creating or calling forth the similarities upon which its function depends.
18. Anyone seeking to learn the empirical concept at issue must thus…
19. … discover the characteristics with respect to which the exemplars are alike, …
20. … the features that render them similar, …
21. … and which are therefore relevant to the determination of reference.
22. It doesn't matter which features of the objects authoritatively presented as similar are employed by someone learning the concept in reproducing the similarity.
23. In other words, it doesn't matter what one leans on in identifying an empirical concept's referents and non-referents, …
24. … for in matching terms with their referents, one may legitimately make use of anything one knows or believes about those referents.
25. All that matters is that the similarity class presented by the exemplars is actually learned as the extension of the target concept.
26. Analogy accentuates those features of both familiar and unfamiliar problem situations, …
27. … by means of which the new may be seen as similar to the old.
28. An analogy must be found between the current problem situation and other problem situations.

29. Empirical concepts cannot in principle be adequately explicated by means of definitions.
30. A given concept has no meaning when taken as an individual, …
31. … but rather has it only when regarded as a dependent moment in a conceptual network.
32. How does a network of similarity and dissimilarity relations acquire its fixed points?
33. To constrain the space of possible decisions without coercing individual choice
34. The role of paradigms in Kuhn's theory is to fix the network of similarity and dissimilarity relations.
35. An occasion only for congratulations, not for surprise.
36. As in individual development, so in the scientific group, maturity comes most surely to those who know how to wait.
37. The epistemic state of members in the community may vary so much so that what is surprising for some is expected for others.
38. A way to manage the risk that the introduction or support of novelty always entails.
39. Resistance guarantees that scientists will not be lightly distracted, …
40. … and that the discovery of anomalies will penetrate existing knowledge to the core.
41. As in manufacture, so in science, retooling is an extravagance to be reserved for the occasion that demands it.
42. The significance of crises is in the signal they provide that the occasion for retooling has arrived.
43. Like artists, creative scientists must occasionally be able to live in a world out-of-joint, …
44. … elsewhere I've described this as the essential tension implicit in scientific research.
45. In learning a paradigm, the scientist acquires theory, methods, and standards together usually in an inextricable mixture.
46. An enterprise that aims to extend, refine, and articulate a paradigm that already exists.
47. Except during crisis and revolution, the scientist's contemporary position seems so secure.
48. What is the process by which a new candidate for paradigm replaces its predecessor?
49. Paradigm-testing occurs only after persistent failure to solve a noteworthy puzzle has given rise to crisis.
50. The competition between paradigms is not the sort of competition that can be resolved by proofs
51. A new scientific truth does not triumph by convincing its opponents and bringing them over to see the light,
52. … but rather because the old generation dies out and a new generation is brought up that is familiar with it.
53. But if a paradigm is ever to triumph, it must gain some first supporters who will develop it to the point where hard-headed arguments can be produced.
54. For many centuries, both in antiquity and again in early modern Europe, painting was regarded as the cumulative discipline.
55. During these years, the goal of the artist was assumed to be representation.
56. Once the arrival of a paradigm has freed a scientific community from the need to constantly re-examine its first principles, …
57. … the members of that community can concentrate exclusively upon the subtlest and most esoteric of phenomena.
58. Just because he is working only for an audience of colleagues, …

59. … an audience that shares his own beliefs and values, …
60. … the scientist can take a single set of standards for granted.
61. The loss to rigidity accrues only to the individual
62. Given a generation in which to effect the change, …
63. … individual rigidity is compatible with a community that can switch from paradigm to paradigm as the occasion demands.
64. A practical tool for eliminating the solipsism characteristic of traditional methodologies.
65. It is the shared taxonomic structure that binds members of the community together, …
66. … and it does not require that individuals give the same answer to the question: …
67. … similar with respect to what?
68. They have over the initiation to science, “absorbed the same technical literature and …
69. … drawn many of the same lessons from it.”
70. Different communities exploring the same field from mutually incompatible points of view.
71. Being able to take no common body of belief for granted, …
72. … each writer on physical optics felt forced to build his field anew from its foundations.
73. In doing so, his choice of supporting observation and experiment was relatively free, …
74. … for there was no standard set of methods or of phenomena that every optical writer felt forced to employ and explain.
75. Juxtapose facts that will later prove revealing with others that will for some time remain too complex to be integrated with theory at all.
76. Those unwilling or unable to accommodate their work to the new paradigm must proceed in isolation or attach themselves to some other group.
77. To achieve a paradigm that proves able to guide the whole group’s research
78. The areas investigated by normal science are miniscule; …
79. … the enterprise now under discussion has drastically restricted vision, …
80. … but these restrictions, born from confidence in a paradigm, …
81. … turn out to be essential to the development of science.
82. To desert a paradigm is to cease to practice the science it defines
83. Though its outcome can be anticipated, the way to achieve that outcome remains very much in doubt.
84. A universal phase model of scientific development
85. Structure is a feature only of temporally extended processes. Point events, in this sense, are fundamentally structureless.
86. A process has structure (or “is structured”) if it is organized in temporally and substantively distinguishable phases.
87. The structure of a given process is a universal feature of that process, i.e. …
88. … every element of a given class of processes has one and the same structure.
89. Without that period of freedom, the transition to a new field of study would have been far more difficult and might not have been achieved at all.
90. Because that education is both rigorous and rigid, these answers come to exert a deep hold on the scientific mind.
91. The strenuous and devoted effort to shove nature into the conceptual boxes supplied by professional education.
92. Discovery commences with the awareness of an anomaly, i.e. …

93. … with the recognition that nature has somehow violated the paradigm-induced expectations that govern normal science.
94. It continues with a more or less extended exploration of the area of anomaly.
95. It closes with an altered paradigm where the anomalous becomes the expected.

These ideas are drawn from:

- *Reconstructing Scientific Revolutions: Thomas Kühn's Philosophy of Science* by Paul Hoyningen-Huene
- *The Structure of Scientific Revolutions* by Thomas Kühn
- *The Essential Tension* by Thomas Kühn
- "The Second Essential Tension: On Tradition and Innovation in Interdisciplinary Research" by Hanne Andersen