(2 20)

1 heteronomous metamerism

2 ovoviviparity

3 parallel evolution

4 adaptive radiation

5 (bony scale)

6 (altrices)

7 (trichocyst)

8 (synsacrum

9 orpharyngeal breathing

10 (parthenogenesis)

0.5 20

1 3

2

3

4

5

6 ,

,

7

8

9 ,

E Na_2HPO_4 F NaH_2PO_4

6.

A

B pH

C MIn MY

D

E MIn MY

7. $KMnO_4$ H_2O_2 5

A H_2O_2

B

C $KMnO_4$ MnO_2

D $KMnO_4$

8.

A

B

C

D

E

9.

A

B

C K_a pH

D

10. A B M(A) > M(B)

A $\varepsilon_A > \varepsilon_B$

B $\varepsilon_A < \varepsilon_B$

C $\varepsilon_A = \varepsilon_B$

D $\varepsilon_A = 1/2\,\varepsilon_B$

11. 20% 12%

A 40% B 50%

C 60% D 70%

E 80%

12.

A

B

C

D

13. H_3PO_4 pK_{a1}~pK_{a3} 2.12 7.20 12.4 H_3PO_4 pH = 6.20 $[HPO_4^{2-}]$ $[H_2PO_4^-]$

A 10:1 B 1:5

C 1:2 D 1:10 E 5:1

14. $BaCl_2$ Ba^{2+} $Ba(IO_3)_2$ KI $Na_2S_2O_3$ $BaCl_2$ $Na_2S_2O_3$ $nBaCl_2 : nNa_2S_2O_3$

A 1:2 B 1:3

C 1:6 D 1:9 E 1:12

0.5 13

1 _____

_____

2 NaOH HCl A_____

B_____ C_____ D_____ E_____ F_____

A $H_2SO_4 + H_3PO_4$ B $HCl + H_3BO_3$

C HF + HAc D NaOH + Na_3PO_4

E $Na_2CO_3 + Na_2HPO_4$ F $Na_2HPO_4 + NaH_2PO_4$

3 A_____ B _____ C_____ D _____

A NaOH HCl

B HCl NaOH

C NH_4^+ HCl NaOH pH = 7.0

D NaOH H_3PO_4 pH = 5

4. A B C D

1 Ca^{2+} Mg^{2+} EDTA Ca^{2+} _____

2 Fe^{3+} Bi^{3+} EDTA Bi^{3+} _____

3 Zn^{2+} Mg^{2+} EDTA Mg^{2+} _____

(4 32)

1 Eutrophication

2 Bioaccumulation

3 Chemical oxygen demand

4 PM2.5

5 (Anammox)

6 (Cation exchange capacity)

7 (Quantum yield)

8 (Flocculation)

1 24

1 (N) _____ _____ _____ _____

2 PM2.5 _____ _____ _____ _____

3

CO_2 NO_3^- SO_4^{2-} _____ _____ _____

4 _____ _____ _____ _____ _____

5 _____ _____ _____ _____

6 / _____ _____ _____ _____

(10 30)

1

2

3

(14 14)

1

2 20

1. priority pollutant

2. conservation biology

3. behavioral toxicity

4. endocytosis

5. microcosm

6. accumulative toxicity test

7. bioremediation

8. pinocytosis

9. bioconcentration

10. facilitated diffusion

1 20

1. 1 2 3

4 5 6 7

8 9

10

2. 11 12 13

14 15 16 17

18 19 20

8 40

1.

2.

3.

1 ET_{50}

2 ED_{50}

3 EC_{50}

4 IC_{50}

5 LT_{50}

4.

5. A-A/O

20

(1 2 30)

1.

2.

3.

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10.

(6 48)

1. (MSY Maximum Sustained Yield)

2.

3.

4.

5.

6.

7.

8

(22)

1.

10

2. - P …… H ∝ O_c → H_c

P ----- ……

H , ∝ O_c

→ H_c -

12

(10 40)

1 CRISPR/cas9

2 DNA

3

4 Wnt/beta-catenin

(20 60)

1 Necroptosis Apoptosis

Necroptosis

2 *In vitro* *In vivo*

3

. (2 20)

1 (Cyanobacteria)

2 (Fungi)

3 (Virosphere)

4. (Invasiveness)

5. (Strain)

6. (Actinomycete)

7. (Schixoteny)

8. (Algal Bloom)

9. (Yeast)

10. (Phage)

. (5 30)

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6

. (2 25 50)

1 ( )

2

3 “ (Metagenome) ”

(2 20)

1 Genetic engineering

2 F Fertility factor

3 Karyotype and karyotype analysis

4 (Balanced lethal system)

5 Heterosis

6 (Split gene)

7 Multiple allelism

8 (Pseudo-dominant)

9 Linkage group

10 (Post-genomics)

1 10

1. 16

2. (b) (d)

3. 4 4

4.

(10 40)

1. ? ? ?

2.

3.

“ ”

4. Genomics, Transcriptomics Proteomics Phenomics

(30)

1. ?

15

2.

15

(2 20)

1

2 Life history traits of fishes

3 Anadromous fish

4. Specific growth rate

5. Feeding rhythm

6.

7. Stability hypothesis

8. Nitrogen budget

9.

10.

0.5 10

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(6 30)

1

2

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(20 40)

1

2

(2 30)

1 (snout length)

2 (ganoid scale)

3 (protocercal tail)

4 (shoulder girdle)

5 (pharyngeal teeth)

6 (lateral line)

7 (precaudal centrum & caudal centrum)

8 (branchial lamellae)

9 (pyloric caeca)

10 (vena portalis renalis)

11 (sinus venosus)

12 (adenohypophysis)

13 (fecundity)

14 (synonym & homonym)

15 (principle of priority)

1 10

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3 _____ _____

4. _____ _____

5. 3 _____ _____ _____

(5 30)

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(10 30)

1 10 10

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3

(3 30)

1 (light compensation point)

2 (photosynthetic primary reaction)

3 (quantum efficiency and requirement)

4 (transpiration efficiency)

5 (biological clock)

6 CAM (CAM pathway)

7 (calmodulin)

8 (programmed cell death)

9 (dedifferentiation)

10 RUBISCO

1 15

1

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5.

（ 1 7 6 25 ）

1

2

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4.

（ 15 30 ）

1

2