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§绪论

1.1地理学概述

1.1.1地理学的定义

定义：研究人与地理环境关系的学科

1.1.2地理学的学科体系

地理环境：自然环境、经济环境、社会文化环境

分支：三分法：自然地理学、经济地理学、社会文化地理学

三层次：统一地理学、综合地理学、部门地理学

三重性：理论地理学、应用地理学、区域地理学

三时段：古地理学、历史地理学、时间地理学

1.1.3地理学的研究对象

研究对象：地球表层系统

地球表层：接近地球物理表面与人类关系密切的地球表层部分。海陆表面上下具有一定厚度范围，不包括地球高空和内部的地球表层。上至对流层顶，下至沉积岩石圈底部。由诸多圈层相互作用形成，以人类为中心，开放的复杂系统。

（1）地球表层的结构

同心圆状圈层构造：

固体部分:从地表到地心密度逐渐加大（地核、地幔、地壳）

液体部分:

上界：江河湖海的水面

下界：江河湖海底部及地下水的最下层

气体部分（大气圈）：分为对流层、同温层、中间层、热成层和外逸层

（2）地球表层的特征：

图1-1

①太阳辐射集中分布和太阳能的转化主要地点

②同时存在着气体、液体、固体三相物质和三个圈层的界面

各界面上三相物质共存，又相互交换，相互渗透，形成多种多样的胶体和溶液系统

③具有本身发展的形成物（例如生物、风化壳、土壤层、地貌形态、沉积岩和粘土矿物等）

表成体：地球表层所特有的物质和现象

④各圈层间进行着复杂的物质、能量交换和循环等，交换和循环过程中伴随着信息的传输

⑤既是一个整体，又存在着复杂的内部分异，其各部分的特征差别显著，在极小的距离内都可能发生变化；分异表现在水平和垂直方向上

⑥是人类社会发展的场所，是人类生活的基本环境

1.1.4地理学的基本理论

1.自然地域三维空间的展开

纬度地带性（纬度）、经度地带性（海陆）、垂直地带性（高度）、

非地带性（地形和基岩）

2.区位空间

核心：距离关系

区位空间秩序的核心：距离衰减

3.人地关系理论：地理环境决定论→或然论（可能论）→协调论

协调论：人类命运与自然环境密切相关，要保护人类必须首先保护自然，人类与自然的关系必须是和谐的关系；人类若破坏自然生态系统，会招致自然的无情报复；在改变或“破坏”的时候，从自然地理环境整体观念出发，通过生态建设以建立新的生态平衡，是决定地理环境发生有利或不利反馈的关键

§地球

2.1 地球在宇宙中的位置

2.1.1天体和星系

1. 天体：宇宙是物质的，宇宙间的物质以各种形态存在着各类星体、星云、星际物质，所有这些物质统称天体。

2.星系：大量的恒星和星云构成巨大的天体系统。

2.1.2天体的分类

星云、恒星、行星、卫星、流星、彗星

2.1.3相关概念

天文单位（14960×104 公里）：地球和太阳的平均距离

光年（94600×108 公里）：光在一年中传播的距离

星系：数十亿到千亿个恒星的集合体

星(系)群：成对或成群的星系

星(系)团：比星系群更大，包括几百个星系

宇宙引力所绑定的最大天体

总星系：已知宇宙的总体

2.2 银河系和太阳系

2.2.1银河系

属于本星系群，由恒星、星云和星际物质组成

2.2.2太阳和太阳系**（重点）**

太阳大气组成：光球、色球、日冕、太阳风（由于日冕高速膨胀导致的行星际空间中从太阳喷发出来的高速粒子流）

太阳系

组成：行星、矮行星、太阳系小天体（小行星、卫星、彗星）

1）行星

定义：围绕太阳运转，自身引力足以克服其刚体力而使天体呈圆球状，能够清除其轨道附近其它物体的天体

类地行星（内行星:体积小密度大，自转速度慢，卫星少）：水星、金星、地球、火星

类木行星（外行星）：木星（最大）、土星、天王星、海王星

八大行星共同特征：

1. 轨道偏心率:都很小，几乎都接近于圆形
2. 轨道面:都近似地在一个平面上，对地球轨道面（黄道面）的倾斜也都不大
3. 公转方向:所有行星都自西向东环绕太阳公转
4. 自转方向：除金星和天王星外，所有行星的自转方向也自西向东，即和公转方向相同；（金星自东向西，天王星是躺着转的，倾角为97度，垂直旋转）
5. 赤道面对轨道面的倾斜：都比较小，只有天王星是唯一的例外
6. 卫星的轨道：绝大多数都近似圆形，其轨道面接近母星的赤道面
7. 卫星公转方向：绝大多数（包括土星环在内）公转方向都和母星的公转方向相同

2）矮行星

定义：具有足够的质量，呈圆球形，不能清除其轨道附近其他物体的天体

代表性矮行星：冥王星（原属行星）、谷神星（原属小行星）

3）太阳系小天体

定义：围绕太阳运转但不符合行星及矮行星条件的天体

分类：彗星、小行星

1. 彗星

组成：彗核、慧发、慧云、彗尾

彗星的形成：慧核在大部分时间里在远离太阳的寒冷空间中运行，其组成物质处于冰冻状态。当慧核在轨道上逐渐接近它的近日点、距太阳足够近时，太阳的热力使慧核中的一部分冻结的气体蒸发或升华，形成云雾状包层（慧发）。彗星继续接近太阳，慧发的直径扩大（可达10万km），形成彗云。慧发中的一部分气体和尘埃，被太阳风和光压推向一旁，漂向远方，形成慧尾。

轨道：偏心率很大，又扁又长

运动：在近日点时比在远日点时快

分类：木星族、土星族、天王星族、海王星族

1. 小行星

分类：C型、S型、M型、稀有类型

亮度逐渐增加

发现：根据提丢斯—彼得定则，在火星与木星轨道之间，距太阳约2.8天文单位处应该有一个大行星；经过长期搜索，始终没有发现这颗未知大行星，却发现了一个小行星带。

月球

特点：没有大气层，没有水，有山脉、丘陵、平原和低地，广泛分布着由火山作用和陨石冲击形成的环形山

没有大气层的后果：既无生物，也不可能形成土壤；裸露的岩石与疏松的尘土共同构成荒凉死寂的外貌；月空永远黑暗，没有风云雷雨等天气现象；月面温度变幅巨大；由于缺乏大气层保护，月面经常遭受陨石撞击

1）公转

根据参考点不同可分为：恒星月、近点月、朔望月、交点月

2）自转

特点：（与公转同步）方向、周期相同，月球始终以同一半球对着地球

对地理环境影响：使地球形成潮汐，尤其是海洋潮汐

3）月相

影响因素：太阳照射月球方向、地球上观测月球的方向

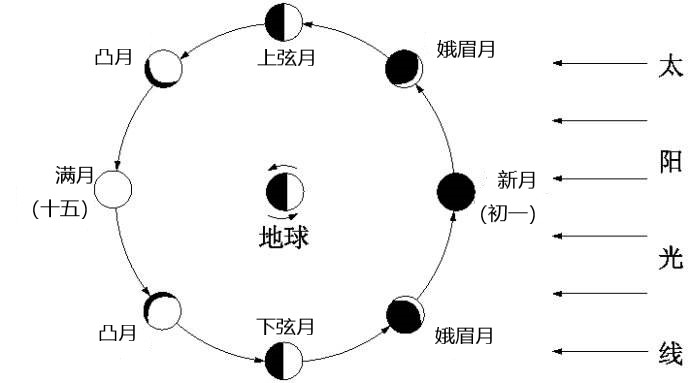


图2-1

2.3 地球在天体中的位置

地心说→哥白尼提出日心说→现代科学观测真实情况

2.4 地球的形状和大小

2.4.1地球的性状及其地理意义

大地测量用平均海平面（大地水准面）来表示的平滑的封闭曲线

形状：地球是一个两极扁平、赤道突出的椭球体：南极凹，北极凸，洋面上至少各有三个较大的隆起区和凹陷区

地球形状意义：当平行光线照射到地球表面时，不同纬度地区的正午太阳高度角各不相同；（太阳高度角：太阳光线与地平面的夹角）

地球赤道面与黄道面的夹角（黄赤交角）决定了太阳正午高度角有规律地从南北纬23°27′之间向两极减小；

太阳辐射使地表增暖的程度按同样的方向降低，造成地球上热量的带状分布和所有与地表热状况相关的自然现象（如气候、植被和土壤等）的纬度地带性分布。

2.4.2地球大小及其地理意义

地理意义：地球的巨大质量和体积，使其能够吸着周围的气体，保持一个具有一定质量和厚度的大气圈。

2.5 地球的运动

2.5.1地球自转

自转方向：在北半球看呈逆时针方向，将其定义为东

证据：傅科摆实验

自转速度：角速度：除两极外每处每日360°，即每小时15°

线速度：赤道最大，到60°N和60°S处几乎减少一半，两极为零

自转变化：长期变化：变慢（潮汐作用）

季节变化：周年变化：由季风变化引起

半周年变化：由大气潮汐引起

不规则变化：地球内部和外部的物质移动及能量交换导致

地理意义：昼夜更替；北（南）半球水平运动物体向右（左）偏转；同一时刻不同经线有不同地方时间；月球和太阳引力造成地球弹性变形（潮汐）；局部运动（如地壳运动、海水运动、大气运动等）；自转加快时导致赤道和低纬海面上升（离心力将海水抛向赤道）

2.5.2地球公转

公转周期（一年）：恒星年：地球连续两次通过太阳和另一恒星的连线与地球轨道的交点

回归年：地球连续两次通过春分点的平均时间

公转方向：自西向东

地球轨道：椭圆形，太阳位于其中一个焦点上。

近日点、远日点

相关概念：太阳的视运动：太阳在天球上运动

黄道：太阳视运动的路线

黄道面：黄道所在的面，与地球轨道面重合。

黄赤夹角：天赤道与黄道面的夹角

春分点和秋分点：天赤道和黄道面相交的两个点

图片包含 文字

自动生成的说明

图2-2

四季更替：地球绕太阳公转，使太阳光线直射的范围在23°27′N和S之间作周期性变动，从而形成了春夏秋冬四季的更替

|  |  |
| --- | --- |
|  | 特点 |
| 春分（3.20/21）秋分（9.22/23） | 太阳光线与地轴垂直；  阳光直射赤道；  阳光照射圈（即昼夜分界的晨昏圈）切过两极；  所有纬线圈都被晨昏圈等分为二，南北半球各纬度上的白昼和夜晚都是12小时。 |
| 冬至 | 太阳直射23°27′S线（南回归线），切过南极圈 (66 °33 ′S)；  南极圈出现极昼，北极圈出现极夜；  北半球夜晚比白昼长，南半球相反；  愈向两极，昼夜长度愈悬殊。在赤道两侧的相应纬度上，昼夜相对长度恰好相反。 |
| 夏至 | 太阳直射23°27′N线（北回归线），切过北极圈（66°33′N）；  北极圈出现极昼，南极圈出现极夜；  南半球夜晚比白昼长，北半球相反；  赤道两侧的相应纬度上，昼夜相对长度也恰好相反。 |

![图片包含 地图, 文字

自动生成的说明](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAlQCVAAD/4SzmRXhpZgAATU0AKgAAAAgACQALAAIAAAAmAAAIhgESAAMAAAABAAEAAAEaAAUAAAABAAAIrAEbAAUAAAABAAAItAEoAAMAAAABAAIAAAExAAIAAAAmAAAIvAEyAAIAAAAUAAAI4odpAAQAAAABAAAI9uocAAcAAAgMAAAAegAAEToc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbmRvd3MgUGhvdG8gRWRpdG9yIDEwLjAuMTAwMTEuMTYzODQAABbi3gAAJxAAFuLeAAAnEFdpbmRvd3MgUGhvdG8gRWRpdG9yIDEwLjAuMTAwMTEuMTYzODQAMjAxODoxMjowMyAxMzoxNjo1MAAABKABAAMAAAABAAEAAKACAAQAAAABAAADY6ADAAQAAAABAAABl+ocAAcAAAgMAAAJLAAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAYBAwADAAAAAQAGAAABGgAFAAAAAQAAEYgBGwAFAAAAAQAAEZABKAADAAAAAQACAAACAQAEAAAAAQAAEZgCAgAEAAAAAQAAG0UAAAAAAAAAYAAAAAEAAABgAAAAAf/Y/9sAQwAIBgYHBgUIBwcHCQkICgwUDQwLCwwZEhMPFB0aHx4dGhwcICQuJyAiLCMcHCg3KSwwMTQ0NB8nOT04MjwuMzQy/9sAQwEJCQkMCwwYDQ0YMiEcITIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIyMjIy/8AAEQgAZwEAAwEhAAIRAQMRAf/EAB8AAAEFAQEBAQEBAAAAAAAAAAABAgMEBQYHCAkKC//EALUQAAIBAwMCBAMFBQQEAAABfQECAwAEEQUSITFBBhNRYQcicRQygZGhCCNCscEVUtHwJDNicoIJChYXGBkaJSYnKCkqNDU2Nzg5OkNERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6g4SFhoeIiYqSk5SVlpeYmZqio6Slpqeoqaqys7S1tre4ubrCw8TFxsfIycrS09TV1tfY2drh4uPk5ebn6Onq8fLz9PX29/j5+v/EAB8BAAMBAQEBAQEBAQEAAAAAAAABAgMEBQYHCAkKC//EALURAAIBAgQEAwQHBQQEAAECdwABAgMRBAUhMQYSQVEHYXETIjKBCBRCkaGxwQkjM1LwFWJy0QoWJDThJfEXGBkaJicoKSo1Njc4OTpDREVGR0hJSlNUVVZXWFlaY2RlZmdoaWpzdHV2d3h5eoKDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uLj5OXm5+jp6vLz9PX29/j5+v/aAAwDAQACEQMRAD8A9/ooAKKACigAooAKKACigAooAKKACigAooAKKACigAooAozX5+2tZWwie4EZch5NuP7vHUgn06Uml3F5cRSNeW/k/NlCHDAgjp0B4ORyPz60riL9FMYUUAFFACM6opZ2CqOSScAVn3Ot2VrepaPJmZiAVH8Oemf89jQBo0zzov8Anon/AH0KAIU1GxknaBLy3aZRkxrKCwHrjNTedF/z0T/voUAHnRf89E/76FHnRf8APRP++hQA4EEZByDS0AFFABRQAVXuL+ytGC3N3BAxGQJZApI/E0AQf23pP/QUsv8AwIT/ABpf7b0rGf7Tssev2hf8aAHrqunOMpf2rD2mU/1obVNPU4a+tQfQzL/jTaaJ5o9zNvPFmmWtx5CSidhgO0TKyxknA3c569gCfap7fxLo80Nuz6laRSTJuVHlCnPQjBweDxU3HdDpfEmhwnEmr2Kkdczr/jWdqWqw6skdtpOr2LLKGjlKyqzDOMHG4ZGM+vUcUNp6IZs2dm0UcTT3DzyRghWJ4Gf58cZPNXKYBRQAisrDKsCM4yDS0AFFAGP4jntl08W80h86Zv3MSAs8jDnCqOT79vWuOvbO6n1a0tdVdLPfCTAtuokuH2YwpABAPLMMA8lueKl36EtXZtTeHv7QjUXqNFGQFEl5cGaUscYwpJRT7YP0qaDwl4dtdShtv7GtpGeCRzJIoboyDoRjv7Y59aXJFu7Q0Wv+EM0FJGltbEWcx/5aWrGM/kDg/Qgig2GqaeFMZh1WFfvJcRrHNj2YAKT7ED60lBRXuoq7H2Ws6BqNrLcLJaJ5JCzrNtVomJwA2enPTse1WbubSLPTX1CZbb7Kg3GVUDDGccY96pNNXQXbIrfxHpUumRXltIz2zsY08qJjyCFxwOOSOvrT18R6Y+oiwWZjOcYGw456c/jTuib62NWimMKKACkKqeoB+ooATy0/uL+VHlp/cX8qADy0/uL+VZ2qtpps7uG7lSBFiBkkwPkDHA6gjkjpzn0pMDkbXRry30y4njlj06JoWVJr9Q7kk8AIeFGQPvZPXCjJq/pWn2GrW9vqEGki5uCuHutTO8ow4YBTk5ByMAKOOtRa+4loamoaJC+mzfap/MJIK7hsjj5HAQcfnk+9WG0+3lj8uaCKZeFIdFIPTtgfy/KqstmF2iodAW3TOmT3GnOOiQPmPPXlCCv6A/zqRNautObZrduI4c4F9EP3X/AxklPrkj3FHw+gF6/1I2jJHFbSzSyKTHgEISATgtg4JCnsf1FZ8sU2sz7hNcLZzW2UVS8RjcjqSOp5H0x9abA0tMsWsLUxPPJMWYuS5ztJxkA9SM5POTz1q7TGFZesaq9giW9nB9q1GcHyLcEDgdWYnoo9foO9JuyAytO0PUObrULrbdSj9+8RBdh6ByPlX/ZUD6nqa181umn+Zp1ntmtbhWLyYLEgEbgc/MRn5ic8BqVrInUrjSNS12ax1CO6lhIUeZKSCCVI+ZRk4yAp4xzuziugv21pLmL+zUtZGMLhlnl2IGyuGwASe/Hv1o1toCuWbS0v5NPWPVbtXuDy5tAYl+gOc/jkVJKmnWRimnECOoCRyS4LnA4AY8k01tqUZt9aS6s0M1jbmzlTJS9kXa6j02dWU91bFLGkOuWc+l6nAkF5EAJo4zwRnKuhx90kZ9iCD0pdQBvCWntp62QknWFGcrhlyN3UZxyKX/hE9PGrx6mrSLNHgKqhAoAIIH3c9vWnYVjdopjCigAooAKKAM7UNbstNivHmkO60iEsigc/NkKB6kkYA+lc/pOkazfznUNVjhtZGk82JGPmNETxkL0DYwASTgcY6ky3d2EdNBp1vDL5zBppz/y1mO5h9Oy/QYFcxrNvc2moz2tvdi1trwNcod2wBhjzATzj+FuBnlulD0QzQtdRgm0OWC4kSeW2KJMikjA3AA5PUcZz3rWDcZ24wRwE+npmgRVu9StbNf3zjeRlYlTc7fRQcmqUk19fROnkrZwEYLSpvkYc5G37oP1J+lAm2UVhttCe1juQbjRxJ8hm6WrngN6FDk+y5446dgMAADGO2KIjQtFUMhurqGytJrq4cJDChd2PYAZNZWjJMY31G5jYXl4N5Ugny0/gjH0HX1JNLqI1i78gDn6VVFpZ2Ur3PlxpI7E+Y3Un2J59ePrQBl2dy2nm4htcXUTvJPBGPk2c5KZOerFiOmAfpVaPWbqDXV8wvPHMMeTEckDja4X0OckjpjmlcDdzqN0VIC2UWec4eUj/ANBX/wAeqW3062tpPNCl5z1mlO5z+J6D2HFUMtVla3azGJNRslBvrMF0B/5aJ/FGfqBx7gGk9gINPudcvJ0ut+mPpksQeIxiQSHOMZzx0rWJueyQ/wDfZ/woV+otRQbjIykWM8/Of8KlpgrmdqrXu2JbHeW3bnCqMbRz1Pftj3rLLa0ddjZPtH2IsCcgY6rnIPI43fr6VLvcZ0tVLlNQaQG1nto48ciWBnOfqHFUBD5Ws/8AP5Yf+Aj/APxyobmHxAbdhbXunCbjaXtXA6/75pO9tAOdsbW91DxBM8sVlcpp7p55t90azT8kD5i2Sm4ntyw6Yrsoby3uJpoYpVaWE7ZE6Mv1FKIE9ZXiGwa/0pvKGZ4D50QxncQDlfoyll/4FVMDItk0yz0gNom6ee4RXUA5IU7c7uy8DvjnNXzbX9yu2eUW0bD5kgYtJn/fIOOPQZ9zUCLEOm21oP3CKhbq+5tzdeSc5J+pqbyU6fJg56MenNMLIZPaQTwNBLsaGRcOrOeR3FYMGq3lrpV5pto5uLrT5BEJR+8YxlSUJ9+NhJzyMnijZgdcmdi5JJxznrTqoZja8rXc2n6aqqyXE4knDD/lnH8x/Ntg/GtPcwAyQOPekHUOerEYB9/WuXuZLu8mvbOMtfDdgbfuoep5zgckDBIO0HGc0MQupabeWllJqBdI1gkE8sFqCWdB9/5+uSBngA/KOa2bG3ghvkeztohbywlzOoyWORjLd8jnn0oQWNSkJCgkkADqTTGUv7SE5AsIjdZJBkB2xD/gXf8A4CDTf7PlusHULgyDvDFlI/x7t+Jx7UgK2hxixnvtKXAjt5fNgQDAWKTJAHsGDj6AVs00AUUAFFABRQAVQ1a8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7We5tbm3IVnkUgCPJZc8E7VGeRjnFfOviz4jeKtD+IkDeIJpPFF58MNYP2m+hID3OmzlSpk8tcFk8uNmymQQcsT0upFU07Xf9f15dDn9pKrFaOOv/A+f9O3Q2vAyX3xW+LljefDdj4R0/SY7MSWDXDRS6VsTEySWpUCZZFITceBgkeh7S4+GPx6+HV3rOi+B7zQdX8J3t3NdxjVlRpAJT80TBgMjA6cjBxyBWgbeHTP2mvAnjjwisl5onjuxmiv0s5k8sMsfmLLIqcMcBuSTypx0APsfxO+Fb+P7rRr/AE/X77wxq+mTF1vdPC75YyrK0T55K/MSOeMnHJyLi09b3Nqa9566rp/X3/d5nGfs+/Fzxf4l8ReI/A/xB0qOx8X6CqTyXFqF8i4hkJKMMH0K4x2HODkV7lXKeB/hrovgE6hLpy3E17qMzXF5fXkxlnuHJJyzH646dAo6KMdXWh0RvbUKKKKCgooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKjuLeK6gkhmjWaGRSjxyKGVlIwQQeoIqSigDw/4h/sb/C74hNNPJoCaJfybibvSGNucnqdg+QnPP3eo78g+N6p+xv8T/h6tzL8OfiQ9zAscKQ2Ooptl+V1ICuSyqFI3DGPuqMZUGvtSispUoTfM1r36/fuTGKj8Oh8dp8Q/wBqP4e6oIdV8F6b4wtmgVmks/uqBkZ3q4AbjJBB6g1Qh/b2urXzb3xX8J9SsUi/dwXMZZlWNwA6MzxqASyjvzwMcZP2nXK/E/xLo/g/wLq2ta9bRXum2MRme3mQOHI6DBB7+gJGCcHFc7ouKv7R2Xft26P9RckdEkrf8E+YP+HiXw81SG2W88La1BtG8q0MYVJo5VaDD+YDsGGJO0n0VhnPnvj79srwzbfHTw3420HT7zWrLTdPubaSFmMJmllj4BYqdoDAdsYwRz8o+mvDnxe+DetaX4euLuPQtFvdaiheCxvrNEcPIFOzds2kgsBkHHNdr4u0nwj4N059Vm8G/wBpt8sf2fR9EN5M3zf8840PTJOT2zScZyV/aLTy6+ev9PciUIvldtvl/TPz98Sftb3Xxg1NR4x1fWtB8NeYXXT/AAnBG8oIAHMsjjBBBHAyAzZLcg954X/au+HPwr0uW/8ABXwd1W72zfvNa1Rws8pJPzvcFJDuJJ4BxkkV7fa/tD/CBtQuNNg8F6m9/byBZ7RPCzNLG7kkBl25BPOAR9K9C8B+ONE8e6jd+H4PAWtaPpEdql3HPrOgPaWk53kFFDoF3DKsPXcxH3TT5KiSiqnztd+u+n5fPUSirJJJ9/8AgfPqfEfi/wD4KgeOjazro3hLS9LEZKNNerJM/JwrJ8yqeRydp+9nAxivHIv2kPiZ8YPEwsfFHxAm0bw5eTJciSETeVa5zvJ8pS2FLECMA9Ac/wB39W/EnwX8CeL7aKDV/CelXcUT70X7MqYbGOq4PSuLX9kD4YWviyw8Q6foP9k3tnjZFZyYgYgnJZGBDEhiD7AfWuKWCxE6qlKs3G+q20+T1/yIjCrCTfNdLZf8H/h+/kfOnw88Mfsn6JdJd6j4vufFupOZGefX47pELttDNsESDvxvLdWOTjI+htL/AGm/gd4V0ryNL8UaPplhEocW2n2jooGABiNI+ThQMAZwBXqP/CCeGv8AoXtK/wDAKL/4mj/hBPDX/QvaV/4BRf8AxNelGl7NctOyXp/wTo97ucDH+1d8JNp/4rvTjyfvBx3/AN2nn9qz4Sj/AJnrS+mfvP8A/E13f/CCeGv+he0r/wAAov8A4mj/AIQTw1/0L2lf+AUX/wATVWqdWvu/4JSslY8L+M3xp+E3xO8AX2kW/wAQNKttSieO9sJ5DIVS5icPGWGBlSRg+xJ7Vtax8cfgJ4g1yz1fUvEeh32o2kTwQzTq7bY2ILKQVwRkA8g8gGvWv+EE8Nf9C9pX/gFF/wDE0f8ACCeGv+he0r/wCi/+JqOSr/Mvuf8AmGl7nnFn+0h8FtHt2gsfF2iWMLEsUtFMYyQAT8qjnAHPsPSr3/DVPwlzj/hO9KzjP32/+Jruf+EE8Nf9C9pX/gFF/wDE0f8ACCeGv+he0r/wCi/+JrazTbX5BocL/wANVfCYLk+OtLx/vNn/ANBp3/DVHwm/6HvSv++2/wAK7j/hBPDX/QvaV/4BRf8AxNH/AAgnhr/oXtK/8Aov/iapX6gcN/w1R8JuP+K70r/vtv8ACl/4ao+E3/Q96V/323+Fdx/wgnhr/oXtK/8AAKL/AOJo/wCEE8Nf9C9pX/gFF/8AE0wOH/4ao+E3/Q96V/323+FIf2qPhMAT/wAJ1pWP99v8K7n/AIQTw1/0L2lf+AUX/wATR/wgnhr/AKF7Sv8AwCi/+JoA4f8A4ao+E3/Q96V/323+FH/DVHwm/wCh70r/AL7b/Cu4/wCEE8Nf9C9pX/gFF/8AE0f8IJ4a/wChe0r/AMAov/iaAOH/AOGqPhN/0Pelf99t/hR/w1R8Jv8Aoe9K/wC+2/wruP8AhBPDX/QvaV/4BRf/ABNH/CCeGv8AoXtK/wDAKL/4mgDh/wDhqj4Tf9D3pX/fbf4V6fa3UV9aw3MEiywTIJI5F6MpGQR9QayP+EE8Nf8AQvaV/wCAUX/xNbNvbxWsEcMMawwxqESONQqqoGAAB0AFAElFFFABXnHxUaXRdf8AB3iVkR9N0u7kivCyMxjjmUJ5nAOApH57Rg549HpjKJFKsAwIwQRkGolFTVn5fhqJq6sVpVstUs45XSG+tSFnjbaJVbHKsvXPqCPwr5gsfivqlx8JLfwh4e0WePV9TWfS7eS+HktmaaaLz0Vht2JlXy5G7G3bzmvqOxsbbTLVLazt4rS3TO2GBAiLkknAHA5JP41n2/hPR7XXLjWY9PhGqT4L3TDc4wu35c/dyDg7cZ75olHmVr/1/X9dCbO90eS/2Tb+FPjJ8PfB1jCo0Ox0O4EcJU7Qdro2QF2/OBzkj7vAPOKPhOz8Ew/Gj4haZpMVjo+ma1otjbNNYrFFb3dwz3QlMTAbDJtliBHJJySK9O8LfCXw54N8Ya14l0q2lg1HVY44ZVMzNDHGpJ2RRk4RSxLYHGTxirR+Gfhc6KmknRrc2KMzop3eYrMQWIkzvBO0Z55AA6DFQqdrpdfL0/y1BwjyqPRHi+i+GrfQ/wBpzwhoOiw6hPYeGfDt5FcXV2C+0SujpmXGGJMmP73BJHc/QmrataaHptxf30y29pAu+SRzwB/Uk4AA5JIArzi8/Zt8D3WuRatHZ3VncpGIXW3u32zRhg219xJxnPQgjccEZr0RdD0/+x4tKezim06KNIltp18xNqY2ghs5xgdfSnDnd1JW7FK/U8m/ZP8ACN/4W+GV5Pf+fG2taxeatBb3AIaGGRwsY2n7oZUEmP8App65Fe0UUVqP0CiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAiuFla3lWB1imKkI7puVWxwSMjIz2yPrXwN8Yv2wvij4O8feIPCFm2k3Q064+zPPDpr75AQo6GRsZZ8dM9Oea+/q/PL46fD+7j+NGoakukWOsaNqeuEza1NBG1rBJLEFjtzM8qITwSwfAVmXGTgHnq3XvRV32uYVFHd/130vqejfsm/Gf4jfGDxheaXqms2ulWOkIl3dWQ0kGSdWfHlh2fKZ65wevA717t8ZdZ8Y+Fo11jQda8O6RpiRLFMusWss808xY7EjCOgyQcde5JwBmvIv2Kfh+1nqfiTxrDYPpGmalBFZ2tv8AZFhjmCMxaaNlldWXIABXAPXnqfWPjr4F8P8AjY+Hf7e0jxBqx0+4e7tf7Cj3eVKNmGk/oOh+arptumuj/rt2H7OEoKKVrdtLfc/1OEh+MnxTbR9Cu9SsPDHhYavK62zanHNMDGAoV32SqELM69yuDnOCDXtngK18UWmhlPF1/p2pat5zsJ9LhaKHyzgqNrEkEcjqc4BzXyL4DtdE8ZXPxa0XWvAfivxDFbXYgsrPyWV4cQ7RGW3BUcugcErgbg2OTX1p8LdIfQfh7oGnyR3sUkFqqtHqEm+dT1IY5J78ZO7GM85qKfRJ3Xz/ABKjFrd3/r+v6Z1dFFFdBocD8U/gl4Y+MEOnrr8NysthMJoLiynMEqsM7fmHOAWJHoSSK4b4R/Ce30T4neLdUtLKQeGDYQ6DGmpHzZLqSBiJZCST5iltwLNjkYx1A93ooJcUzzrwn8BfCHgbxXba3oGmrp3kQSQx2qO7RxM5XLxhmPl5AIZR8rEhsbhk+i0UUFBRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFeIfHLUNLHinTrTxAJ9U0aKya5TR4GKLLcbmVWlPA2kZAILFSp+UZ5KKmSUlZkyipK0tj5w8E/EKz+G/wARIfE3xVR9X0+1VovDtxGfNOlgszbPLAGX27ADyoAc5yfm+yNS8RXnjzwPqFz4A1W3i1PPlwXV5bt5aSDaxBVhzwR279jyCisnFqUYX0ab/FdjOHvc67O34I+cdD0PxHofiLR/htd6npVxL4gS61TUtVjtGEtzOs0WGdjk7stI3HBaQ8gEge6fAuw8V6HY+IdE8S65H4jt9K1FrbTtSkUi5kh2K+2bsWXeACKKKzpVLy5bJK362POwVaVZU5StrG/4nqFFFFdZ64UUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBBdQ/arWaHe0fmIyb1CkrkYyAwIP4gj1BrzR/gPp2uafDYeKdRm8QaXC4ZNKWJbayOAcboVyC2WJ3ZBzzRRSst7EyipatFTR/gHN4U1rT5PDnjbXtI8P2k3nHQPO862YbsmNdx/dp2CKAo7g5Iq/wCOPhV4j8Va9d3+n/EfWvDltMkax2VjGpSHaBkjJ5LHOcj6epKKnlQJWVjidL/Zb8QaLeald2Hxd8RWdzqUwuLyaG1gVp5AoUMxxycKP1PUmvXPh54T1LwboLWGqeJL7xVdGdpft+oKBLtIACYHGBg9AOvTOSSirKOoooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooA//Z)

图2-3

2.6 地理坐标

2.6.1纬线和纬度

地轴：南北两极的连线，即地球自转的轴线

地心：地轴的中点

赤道：通过地心并和地轴垂直的平面与地表相交而成的圆

纬线：与地轴垂直的面和地表相交的线

纬度：某地铅垂线对赤道的夹角

2.6.2经线和经度

经线圈：所有通过地轴的平面和地球表面相交的圆。每个经线圈都包含两条相差180°的经线，一条经线只是一个半圆弧

本初子午线：穿过伦敦格林尼治天文台的经线

经度：某地所在经线与本初经线的角距，即过该店的子午面与本初子午面的二面角

2.7 地球的圈层构造

2.7.1地球的圈层分化

原始地球是接近均质的，各种物质并没有明显的分层现象。同整个地球的温度变化过程有密切的关系；放射性元素的辐射能量在地球内部的积累，使那里的温度逐渐升高，使得物质具有可塑性；重力的作用使得物质便发生分异，逐渐形成性质不同的圈层。

1. 地核的形成

原始地球的铁元素因为温度超过了它的熔点而以液态出现。液体铁由于密度大而流入地心，形成地核。

1. 圈层的分化

重物质向地心集中的同时发生压缩，压缩功转变为能量又使地球局部增温和熔化；与此同时伴随着物质的对流发生大规模的化学分离；地球内部分化为地核、地幔、地壳三个圈层。

1. 大气圈的形成

在分化的过程中，地球内部的气体经过“脱气”形成了大气圈。地球原始大气主要由二氧化碳、一氧化碳、甲烷和氨组成。

1. 水圈的形成

主要从大气中分化而来；早期的大气含有大量水汽，温度的逐渐降低及大气中大量的尘埃颗粒，使得部分水汽凝结成液态水降落在地球表面，汇集在洼地中，形成了原始水圈；彗星的冰物质也是水的来源之一。

1. 生物圈的形成

在原始地壳、大气圈和水圈中，存在着碳氢化合物。原始生物出现后，逐渐扩展到海洋、陆地和低层大气中，形成生物圈。

2.7.2地球的内部构造

图2-4

|  |  |  |  |
| --- | --- | --- | --- |
|  | 定义 | 组成 | 图示 |
| 地壳 | 地表至莫霍洛维奇面（莫氏面）之间厚度极不一致的岩石圈的一部分。 | 大陆地壳（硅铝层、硅镁层）、海洋地壳（硅镁层） |  |
| 地幔 | 莫霍洛维奇面以下，深度为35-2900km（古登堡面）的圈层 | 上地幔（软流圈）、下地幔 | 图片包含 文字, 地图  自动生成的说明 |
| 地核 | 2900km以下至地心 | 外核、过渡带、内核 |  |

莫霍洛维奇面：地壳下部，地震波的传播发生突变，说明那里有一个界面。

2.7.3地球的外部构造

1）大气圈 2）水圈 3）生物圈

地球圈层共同特点：

在高空和地球内部，基本上是上下平行分布的；

在地球表面附近，各圈层却是互相渗透甚至互相重叠的，这一特点赋予地球表面一系列独特的性质；

地球表面这个特殊的圈称为地理圈或地理壳，是自然地理学的研究对象。

2.8 地球表面的基本形态和特征

2.8.1海陆分布

2.8.2海陆起伏曲线

泛对称现象：大陆面积越大，其平均海拔越高。大洋深度分布同样表现泛对称性。

2.8.3岛屿

分类：大陆岛、海洋岛

|  |  |  |
| --- | --- | --- |
| 大陆岛 | 位于大陆附近并在地质构造上与相邻大陆有密切联系的岛屿 | 成因：本来是陆地的一部分，由于大陆的某些部分发生破裂或沉陷而被海水所淹没，使它与大陆分离，形成了岛屿。它的基础仍固定在大陆架或大陆坡上。（海南岛、台湾岛） |
| 海洋岛 | 面积比大陆岛小，与大陆在地质构造上没有直接联系，从来不是大陆的一部分。 | 分类：火山岛：海底火山喷发形成的岛屿（夏威夷）  珊瑚岛：由珊瑚礁构成的岩岛（马尔代夫） |

§地壳

关于岩石圈

组成：由地壳和上地幔顶部坚硬岩石组成的地球圈层

分层：地壳（硅铝层、硅镁层）、上地幔顶部

3.1地壳的组成物质

3.1.1化学成分与矿物

1）化学成分组成：O、Si、Al、Fe、Ca、Na、K、Mg……

2）矿物

定义：单个元素或若干元素在一定地质条件下形成的具有特定理化性质的化合物，是构成岩石的基本单元。

分类：按成分种类：天然单质矿物、化合物矿物

按晶体化学原则：自然元素、硫化物、卤化物、氧化物、氢氧化物、含氧盐……

内部结构：晶体结构、非晶体结构

外形：大部分矿物属于晶体结构，表现一定的几何形体；成分相同的物质因形成环境不同可有不同的结晶构造和外形。

鉴别矿物依据：矿物形态、光学性质（透明度和光泽）、力学性质（硬度、解理、断口、弹性、挠性、延展性，解理只在晶体矿物上发生，断口在晶体和非晶体矿物上都可能发生）

常见造岩矿物：长石（钾长石和斜长石）、石英、云母、角闪石、辉石、橄榄石、方解石

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 颜色 | 无色 | 浅色 | 彩色 | 黑色或金属色 | | |
| 条痕 | 无色或白色 | 浅色或无色 | 浅色或彩色 | 黑、绿黑、灰黑、褐黑或金属色 | | |
| 光泽 | 玻璃金刚 | 半金属 | | | | 金属 |
| 透明度 | 透明 | 半透明 | | | 不透明 | |

3.1.2岩石

分类：岩浆岩、沉积岩、变质岩

1. 岩浆岩（火成岩）

分类：侵入岩、火山岩（喷出岩）

矿物组成：（按SiO2含量划分）超基性岩、基性岩、中性盐、酸性盐

产状：岩层的产出状态，包括岩层的倾角、走向和倾向等。岩体在形成时期所处的地质构造、环境和距离地表的深度及其形成的方式不同而导致产状不同。

喷出岩产状：火山锥、熔岩流、熔岩被

侵入岩产状：（深成侵入岩）岩基、岩株

（浅成侵入岩）岩床、岩墙、岩盖、岩盆

结构：（所含矿物的结晶程度、晶粒大小、晶粒相对大小、晶体外形和矿物间结合的关系，反映了岩浆冷凝速度的快慢）玻璃质（快速冷却）、隐晶质（较慢冷却）、显晶质（缓慢冷却）、斑晶和斑状（先慢后快）。

构造：块状构造、斑杂构造、流纹构造、气孔构造、杏仁状构造

1. 沉积岩（水成岩）

定义：由成层堆积于陆地或海洋中的岩矿碎屑、胶体和有机物质的疏松沉积物经固结而成的岩石。

成岩过程：原来的沉积物不断被新的沉积物覆盖而加厚时，它便与上层的水体隔离开来，形成厌氧的环境：

有机质腐烂分解，产生各种还原性气体；

碳酸基矿物溶解为重碳酸盐；

某些金属元素的高价氧化物还原为低价的硫化物；

软泥中水的矿化度增加，介质亦由酸性的氧化环境变为碱性的还原环境；

沉积物发生重新组合，形成新的次生矿物，胶体经脱水陈化为固体，碎屑物经压缩、胶结等作用，固结成为岩石。

沉积岩的成岩作用：压固作用、胶结作用、重结晶作用、生成次生矿物（新矿物生长）

图片包含 文字

自动生成的说明

图3-1

沉积物来源：风化沉积物、有机沉积物、火山沉积物、宇宙降落物

主要类型：碎屑岩类、粘土岩类、生物化学岩类

1. 碎屑岩类

由母岩机械风化的碎屑经胶结物胶结而成的岩石

分类：砾岩、砂岩、粉砂岩

1. 粘土岩类

由大量粘土矿物和其他细微物质组成，硬度低

分类：泥岩（固结好但无层理）、页岩（固结好且有层理）、粘土（固结差）

1. 生物化学岩类

代表性岩类：碳酸盐类（石灰岩、白云岩）……

（化石）

1. 变质岩

定义：由变质作用形成的岩石

变质作用：地壳中原有的岩石，经构造运动、岩浆运动、地壳内的热流变化等内动力的影响，使其矿物成分和结构、构造发生不同程度的变化。

变质作用三大要素：温度、压力、化学活动性流体（岩浆）

变质作用类型：动力变质作用、接触热变质作用、区域变质作用、混合岩化作用

三大岩类成岩过程比较：

岩浆岩：由岩浆自下而上逐渐冷凝形成的岩石，它的形成是一个降温降压的过程。

沉积岩：母岩是先成的各类岩石经过风化、剥蚀、搬运、沉积、固结成岩作用形成的岩石，这个过程多半是在水介质中进行的，一般是常温常压。

变质岩：母岩是岩浆岩和沉积岩，而变质作用的过程是一个升温升压的过程。

3.2构造运动与地质构造

3.2.1构造运动的特点与基本方式

定义：由于地球内动力作用所引起的地壳机械运动

作用结果：使地壳发生变形和变位，形成各种形迹的地质构造，并促使岩浆活动和变质作用。

特点：普遍性和永恒性、方向性、非均速性、幅度与规模差异性

基本方式：水平运动：指地壳或岩石圈块沿大地水准面切线方向的运动，使岩层发生水平位移

垂直运动：指其垂直于地表即沿地球铅垂线方向的升降运动，使岩层发生隆起与拗陷

3.2.2构造运动与岩相、建造和地层的接触关系

1）岩相

岩层形成环境的物质表现，是沉积物的特征及其生成环境的总和

岩相分类：海相、陆相、过渡相

2）沉积建造

定义：彼此有共生关系的岩石或岩相的组合，或者岩性大致相同的沉积物组合。

沉积构造分类：地槽型建造（主要由海相地层组成）、地台型建造（以陆相碎屑沉积为主）、过渡型建造（兼有两者建造标志，碎屑沉积占优势，潟湖沉积、大陆沉积分布广泛）

3）地层的接触关系

分类：整合：邻近新老底层产状一致且平行，时代连续

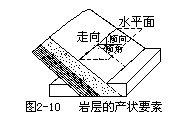
假整合：相邻地层产状平行，但时代不连续

不整合（角度不整合）：相邻地层产状既不平行，时代也不连续

3.2.3地质构造

定义：承受地壳运动的岩层或岩体，在地应力的作用下发生变形变位的结果。

方式：压性构造、张性构造、扭性构造

构造类型：水平构造、倾斜构造、褶皱构造、断裂构造

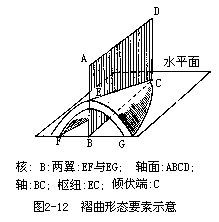
1. 水平构造

典型地貌：丹霞地貌

1. 倾斜构造

产状：走向、倾向、倾角

图3-2

典型地貌：单面山、猪背岭

1. 褶皱构造

岩层单个弯曲称褶曲，两个及以上的褶曲组合称为褶皱

褶曲要素：翼：褶曲岩层的两坡

轴面：使两翼成近似状态的假想面

核：褶曲岩层的中心

枢纽：轴面与岩层层面的交线

倾伏：其倾斜则称倾伏

褶皱的基本形态：背斜和向斜

图3-3

背斜：指岩层向上拱起的弯曲，特点是核部的岩层相对较老且向上隆起而倾斜向外的岩层时代较新。

向斜：指岩层向下凹的弯曲，特点是剥蚀后中间（槽）的岩层相对较新，两翼的则较老。

1. 断裂构造

分类：节理、断层

1. 节理

图片包含 文字, 地图

自动生成的说明分类：构造节理（由构造运动形成）、非构造节理（原生节理、风化节理）

1. 断层

分类：正断层、逆断层、评议断层

断层要素：断层面、断层线、

断盘（上盘、下盘）、短距

3.3大地构造学说

3.3.1板块构造学说

1）大陆漂移学说

图3-4

证据：大陆轮廓的贴合、地质构造带对比、古生物证据、古冰川和气候证据

中心思想：在古生代后期（约三亿年前）地球上存在一个“泛大陆”及一个“泛大洋”：

大陆由较轻的含硅铝质的岩石组成，漂浮在较重的含硅镁质的岩石之上（洋

底就是由硅镁质组成的），并在其上发生漂移；

在地球自转离心力和天体引潮力作用下，泛大陆的花岗岩层分离并在分布于

整个地壳中的玄武岩层之上发生漂移，逐渐形成了现代的海陆分布。

疑点：（动力解释不到位）硅铝质大陆漂移在硅镁质的洋壳

（漂移的动力为海洋中的潮汐，以及太阳和月亮的引力，拍打大陆的岸边，引起微小的运动，日积月累使巨大的陆地漂到远方）

2）海底扩张说

证据：磁异常与磁场倒转记录、海底的扩张速度

中心思想：大洋中脊和裂谷体系是地幔物质上升的涌出口，涌出的岩浆冷凝成新的洋底。由于不断涌出和冷凝，结果导致洋底向两端不断扩张，导致新的海洋地壳不断的发生，不断向外扩张。

海底扩张的原动力主要来自地幔物质的对流，大陆漂移也是由于海底扩张引

起的。

缺陷：中洋脊涌出的岩浆无法提供足够的动力，地壳的厚度无法说明大陆漂移或海底扩张的过程中不会发生形变。

3）板块构造说

板块构造说将海底扩张、大陆漂移、地震与火山活动、山脉的形成等现象纳入一个理论体

系中，用统一的动力学模式来解释全球性的构造运动的过程及其相互关系。

中心思想：全球岩石圈分为若干板块（岩石圈），各板块在不断移动、不断更新，并产生各种地质现象；各板块在软流圈之上移动。

证据：古生物证据、古冰川和气候证据、中洋脊两侧岩层年代及地磁倒转的证据、发现班尼奥带、发现软流圈

六大板块：太平洋板块、亚欧板块、美洲板块、非洲板块、印度洋板块、南极洲板块

3.3.2地槽-地台说和地洼说

3.3.3地质力学学说

3.4火山和地震

3.4.1火山

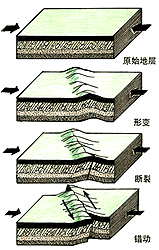
定义：岩浆穿过地壳溢出或喷出地表的地方（不一定是山）

分类：按活动情况：死火山、活火山、休眠火山

按火山喷发类型：中心式喷发（宁静式、爆裂式、中间式）、裂隙式喷发

板块构造说与火山形成

火山形成：板块运动是地球内部软流圈热对流造成的；板块互相推挤，密度高的一边下降到另一边下方，称作隐没，发生隐没的带状区域称为隐没带或聚合性板块交界；地底高温将隐没板块熔融，形成岩浆；岩浆借浮力上升，聚集成为岩浆库；岩浆中气体压力累积到一定程度，火山爆发。

火山喷出物：液体（熔岩）、气体（H2O、H2、HCl、H2S、CO、CO2、HF等）、固体（山山尘、火山灰、火山弹、火山块）

火山的分布：环太平洋带、阿尔卑斯-喜马拉雅山带、洋中脊与东非裂带

火山的影响：直接灾难、间接灾难、对气候影响、塑造土地和生命

3.4.2地震

定义：大地快速震动

成因：构造地震（主）、火山地震、塌陷地震、诱发地震、人工地震

形成原理：地壳存在水平或垂直方向的地壳运动；刚性地壳阻碍地壳运

动，引起缓慢运动的应变能积累；应变能积累到超过刚性地

图3-5

壳岩层或岩体承受度造成刚性地壳的快速断裂或错动；断裂

或错动急剧的释放所积聚的能量，并以弹性波的形式传播，

引起地表震动。

地震波：体波：横波（较纵波慢，破坏性强）、纵波（较横波块）

面波

地震要素：震源、震中、震源深度、震中距

按震源深度分类：浅源地震（主）、中源地震、深源地震

衡量尺度：震级（地震释放能量的大小，里氏震级）、地震烈度、地震序列

地震灾害：直接灾害、次生灾害

3.5地壳的演变

3.5.1地质年代

计算方法：相对年代（古生物地层法）：宙、代、纪

绝对年代：放射性同位素测定

太古代、元古代、古生代、中生代、新生代

§大气和气候

4.1大气的组成和热能

4.1.1大气成分

1）干洁空气

组成：N2（不活泼、固氮作用）、O2（燃烧）、CO2（吸收长波辐射，保温作用）、O3（吸收紫外辐射）等

2）水汽

来源：水面蒸发（海洋蒸发）、植物蒸腾作用

分布特点：随时间地点变化，与大气环流、海陆分布密切相关，含量随高度增加而减少，每年更替32次，即11天更替一次

作用：唯一发生相变的大气成分，强烈吸收和放出长波辐射能，在天气变化、能量交换及

大气与地面能量交换有重要作用

3）固、液体杂质

组成：水汽变成的水滴和冰晶、大气尘埃、其他杂志

影响：本身可能是有害物；有害物质的运载体或反应床；散射太阳光，使能见度下降，同时改变地球辐射平衡，影响地面温度变化；对云雨形成有重要作用；可在全球范围内扩散迁移。

4.1.2大气的结构

气压变化：周期变化：日变化、年变化

非周期变化

大气分层：（按温度和运动情况）对流层、平流层、中间层、暖层、散逸层

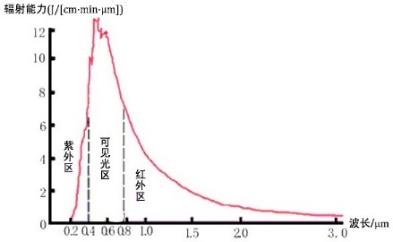
|  |  |  |
| --- | --- | --- |
|  | 范围 | 特点 |
| 对流层 | 地面至对流层顶（上界范围因季节和纬度不同，低纬和夏季厚度大） | 1. 集中了3/4大气质量和几乎全部水汽 2. 主要天气现象发生在此层 |
| 平流层 | 对流层顶至50-55km | 1. 气温受地面影响小 2. 水汽、尘埃少，无天气现象，大气透明度好 3. 上热下冷，空气多为平流运动，垂直对流运动少 |
| 中间层 | 平流层顶至85km | 1. 气温随高度增加迅速下降，顶部-83℃ 2. 下热上冷，有垂直对流运动，又称高空对流层或上对流层 3. 虽有强烈对流运动，但因空气稀薄，不能与对流层相比 4. 层内水汽很少，几乎无云，高纬地区偶尔出现夜光云 |
| 暖层（热层、电离层） | 中间层顶至800km | 1. 大气密度小，仅占大气总质量0.5% 2. 由于吸收紫外辐射，气温随高度增加迅速升高，顶部1000℃以上 3. 空气处于高度电离状态，对电波传播影响很大 4. 受电离层影响波段：极低频至高频，中波和短波段影响最大 |
| 散逸层 | 暖层顶以上，无明显边界（地球大气与星际空间过渡区域） | 1. 空气极其稀薄 2. 大气质点碰撞频率很低 3. 温度随高度升高而升高 |

4.1.3大气的热能

太阳辐射：太阳以电磁波的形式向外传递能量

太阳辐射能：太阳辐射所传递的能量

太阳辐射强度：单位时间内垂直投射在单位体积上的太阳辐射能

太阳常数：在日地平均距离D上，大气顶界垂直于太阳光线的单位面积上每分钟接受的太阳能

紫外光<0.4μm，可见光0.4-0.76μm，红外光>0.76μm

图4-1

太阳辐射的去向

1）太阳辐射在大气中的减弱（55%）

吸收作用、反射作用、散射作用

|  |  |
| --- | --- |
| 减弱方式 | 定义与特点 |
| 吸收作用 | 将投射到物质面上的辐射能中一部分转变为物质本身的内能，或其他形式能；主要削弱紫外和红外部分，对可见光影响较少 |
| 反射作用 | 大气中云层和较大的颗粒将太阳辐射中一部分能量反射到宇宙中去。平均反射率随云高增加而减小，50-100m厚的云层几乎能将太阳辐射全部反射。 |
| 散射作用 | 只改变辐射方向，已质点为中心四面传播，使到达地面的太阳辐射量减少  晴空：起散射作用主要是空气分子，波长较短的蓝光被散射50%以上，天空呈蔚蓝色  阴天或大气尘埃较多：起散射作用的主要是直径比辐射波长大得多的大气悬浮粒子，对散射光没有选择性，天空呈灰白色 |

（反射和散射的区别：反射有一定的角度与规律，并且即改变辐射的方向也改变能量总

量；散射没有特定角度与规律，只改变辐射的方向不改变能量总量。）

2）到达地面的太阳辐射（45%）

|  |  |
| --- | --- |
|  | 影响因素 |
| 总辐射 | 太阳高度角、大气透明度、云量等 |
| 直接辐射 | 1. 太阳高度角：引起直接辐射的日变化、年变化和纬度变化 2. 大气透明度：大气透明度越差，太阳辐射减弱越强，到达地面的太阳辐射也相应减少 |
| 散射辐射 | 1. 太阳高度角：太阳高度角增大，直接辐射增大，散射辐射相应增大 2. 大气透明度：大气透明度越差，参与散射的质点越多，散射辐射增强 |

总辐射的变化：日变化：夜间总辐射为零，日出前达到极小值；日出后逐渐增加，正午达到最大值。云的影响可以使这一过程提前或延后。

年变化：月均总辐射值以夏季各月最大，冬季各月最小；总辐射量空间分布因纬度而不同。

大气能量及其保温效应

大气本身吸收太阳辐射很少，而下垫面大量吸收太阳辐射，并经潜热和感热转化供给大气

地面长波辐射是大气的第二热源，若无这些能量，近地面平均温度将降低40℃

大气获得能量方式：太阳辐射直接吸收、地面辐射直接吸收、潜热输送、感热输送

|  |  |
| --- | --- |
| 太阳辐射直接吸收 | 吸收太阳辐射物质：O3、水汽、液态水，N2和O2对太阳辐射吸收微弱 |
| 地面辐射直接吸收 | 大于3μm的长波（红外）向外辐射，75-95%被大气吸收，极少部分波长为8.5-12μm的辐射通过“大气窗口”逸回宇宙空间 |
| 潜热输送 | 海面和陆面水分蒸发到大气层中，水汽凝结成雨滴和雪时放出潜热。潜热输送是地气间能量交换主要方式。 |
| 感热输送 | 由于陆面、水面温度和低层大气温度不相等，从而产生感热交换 |

大气辐射和大气逆辐射

大气辐射：大气获得热能后依据本身温度向外辐射，一部分外逸到宇宙空间，一部分向下投向地面（大气逆辐射）

大气逆辐射的意义：使地面实际损失热量略少于以长波辐射放出的热量，使地面保持一定温度（现在地面均温为15℃，若无大气逆辐射，地面均温为-18℃）

地气系统的辐射平衡

辐射差额（辐射平衡、净辐射）

4.1.4气温

影像气温因子：地理位置、海拔高度、气块运动、季节、时间、地面性质

气象台气温：距地面1.5米的百叶窗温度

观测时间：2am、8am、14pm、20pm

气温的周期变化：日变化、年变化

|  |  |  |
| --- | --- | --- |
| 日变化 | 定义：一日之内有一个最高值（14点，热量积累最多的时候）和一个最低值（日出前后） | |
| 日较差 | 定义：一天中气温的最高值和最低值之差。反应气温日变化程度。 |
| 变化：高纬气温日较差比低纬小（纬度）； 夏季气温日较差大于冬季（季节）； 内陆比海洋大，山谷比山峰大（地表性质）； 阴天比晴天小（天气）。 |
| 年变化 | 定义：一年中月平均气温的最高值和最低值之差 | |
| 年较差 | 定义：一天中气温的最高值和最低值之差。反应气温日变化程度。 |
| 变化：高纬比低纬大（纬度）；  植被覆盖比裸地小（地表性质）；  凸地小于凹地（地形） |

气温的空间分布

1）水平分布

表现形式：等温线：将气温相同的地点连结起来的曲线

影响因素：地理纬度、海陆分布、大气环流、地形起伏、洋流

特点：

1. 等温线分布的总趋势大致与纬度平行
2. 同纬度地区：

夏季海面气温低于陆面

冬季海面气温高于陆面

1. 洋流对海面气温影响很大
2. 近赤道地区（5°~10°N）：有一个高温带（热赤道），月平均温度冬夏均高于24 ℃
3. 南半球：无论冬夏，最低气温都出现在南极（ -90℃）
4. 北半球：最低气温夏季出现在极地，冬季出现在高纬大陆

最高温度在低纬度大陆上（索马里63 ℃ ）

2）垂直分布

总规律：气温随高度升高而减低

气温垂直递减率（气压垂减率）：单位高度（100m）气温变化值

气压垂减率特点：随地点、季节、昼夜的不同而变化；在夏季和白天，地面吸收大量太阳辐射，地温高，地面辐射强度大，近地面空气层受热多，气温直减率大；冬季和夜晚直减率小。

4.2大气水分和降水

4.2.1大气湿度

湿度：大气的湿度状况是决定云、雾、降水等天气现象的重要因素

湿度参数：水汽压、饱和水汽压；绝对湿度、相对湿度；露点温度

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 水汽压与饱和水汽压 | 水汽压e | 定义 | 大气中水汽所产生的压力 | |
| 饱和空气 | 当水汽含量恰好达到一定体积的空气中所容纳的水汽数量的极限时的空气 | |
| 饱和水汽压E | 定义 | 饱和空气的水汽压 | |
| 与温度关系 | 温度越高，空气中容纳水汽能力越强，饱和水汽压越大 | | |
| 相对湿度与绝对湿度 | 绝对湿度a | 定义 | 单位容积空气中所含的水汽质量 | |
| 与水汽压的关系 | a=289e/T（g/m3） | |
| 与温度关系 | T=289K（t=16℃）时，a=e；一般气温数值与16℃相差不大，以毫米水银柱高为单位的水汽压与绝对湿度在数值上近似，故在实际工作中以水汽压代替绝对湿度 | |
| 相对湿度f | 定义 | 大气中实际水汽含量与饱和时水汽含量的比数，即e与同温下E的比值 | |
| 表达方式 | f=e/E×100% | |
| 与空气饱和度关系 | 饱和 | e=E，f=100% |
| 未饱和 | e<E，f<100% |
| 过饱和 | e>E，f>100% |
| 日变化 | 与气温日变化相反：最高值：日出前 最低值：午后 | |
| 年变化 | 一般：最大：冬季  最小：夏季  沿海地区：最大：夏季（风；来自海洋）  最小：冬季（风；来自内陆） | |
| 露点温度 | 定义 | 湿空气等压降温达到饱和的温度 | | |
| 特点 | 露点完全由空气水汽压决定，汽压一定时，它是等压冷却过程的保守量 | | |
| 露点差与空气饱和程度关系 | 差值越大，相对湿度越低；气温降低至露点，时水汽凝结必要条件 | | |

4.2.2蒸发和凝结

1）蒸发

定义：液态水转化为水汽的过程

条件：取决于实际水汽压e和饱和水汽压E二者的对比关系

e<E：蒸发进行 e>E：蒸发停止，可能产生凝结 e=E：处于动态平衡

影响因素：水源、热源、饱和差（蒸发速度和饱和差成正比）、风速与湍流扩散（大气中的水汽垂直输送和水平扩展能加快蒸发速度）

2）凝结

定义：水汽由气态变为液态的过程

条件：大气中水汽要达到饱和或过饱和状态（增加水汽含量、大气降温），有凝结核或凝华核的存在

凝结核：大气中存在的大量吸湿性微粒物质，对水汽分子大得多，对水分子吸引力大，有利于水汽分子在其表面聚集，使其称为水汽凝结核心。凝结核半径越大或吸湿性越好越易产生凝结。

4.2.3水汽的凝结现象

地表凝结物：露与霜、雨凇与雾凇

大气凝结物：雾、云

1）露与霜：气温降低至露点以下，水汽凝附于地面或地面物体上

露：0℃以上，液态 霜：0℃以下，固态（冰晶）

相关概念：初霜日：冬后第一次出现的霜日

终霜日：最末一次出现的霜日

霜期：自初霜日起至终霜日止的持续期。在此期间多数植物停止生长。

无霜期：自终霜日起至初霜日的持续期。

2）雾凇和雨凇

雾凇：白色固体凝结物，过冷雾滴附着于地面物体上迅速冻结而成

雨凇：平滑透明的冰层，过冷雨滴接触物体表面或长期严寒后雨滴降落在极冷物体表面

对环境影响：通常形成于树枝和电线上，在物体迎风面上增长，且在受风面大物体上凝聚最多，造成林木破坏、电线折断以及农业和交通的不良影响等等

3）雾

定义：飘浮于近地面空气中的大量水滴或冰晶，使水平能见度小于1000米的物理现象

对环境影响：雾可清洗空气中的一些粒子污染物或气体污染物；由于雾是在近地面气层非常稳定条件下产生的，在这种条件下，污染物不易扩散，雾的出现可能造成不利的地面空气污染情况。

基本条件：近地面空气中水汽充沛；温度冷却；存在凝结核；贴近地气层中的水汽压大于其饱和水汽压时，水汽凝结成雾。

分类：辐射雾、平流雾、蒸汽雾、上坡雾、锋面雾

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 定义 | 形成条件/成因 | 特点 | 分布 |
| 辐射雾 | 夜间地面辐射冷却，贴近地面气层变冷而形成的雾 | 空气中水汽充沛；风力微弱；晴朗少云；大气层结稳定 | 辐射雾在大陆上最为常见，尤以山谷、盆地为多。常出现于高气压的晴夜，它的出现将预示着白天将是一个晴好的天气 |  |
| 平流雾 | 暖湿空气流经冷下垫面而逐渐冷却形成的雾 | 下垫面与暖湿空气的温差较大；空气的湿度大；有适宜的风向核风速；层结较稳定。 | 平流雾的范围广，而且深厚，有适宜的风向、风速，常可坚持很久。但只要暖湿空气来源中断，雾立即消散。 | 我国沿海春夏季节的海雾，即是平流雾。 |
| 蒸汽雾 | 冷空气移动到暖水面上形成的雾 |  | 可在一日中任何时间形成，也可终日不散 |  |
| 上坡雾 | 潮湿空气沿山坡上升使水汽凝结而产生的雾 | 潮湿空气必须处于稳定状态，山坡坡度也不能太大，否则就会产生对流而形成层云 | 北冰洋的冬季较为常见（极地烟雾或北极烟） | 在我国青藏高原、云贵高原的东部经常出现 |
| 锋面雾 | 发生于锋面附近的雾 | 主要是暖气团的降水落入冷空气层时，冷空气因雨滴蒸发而到达饱和，水汽在锋面底部凝结而成 | 深秋或初冬的早晨，见于河面，湖面的轻雾（河、湖烟雾） | 我国江淮一带梅雨季节常常出现锋面雾 |

4）云

定义：高空水汽凝结现象

形成原因：空气对流、锋面抬升、地形抬升，使空气上升到凝结高度

分类：高云族、中云族、低云族

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 高度范围 | 组成 | 特征 | 云类 |
| 高云族 | 下限高度6000米 | 冰晶 | 白色，有绢丝光泽 | 卷云；  卷层云；  卷积云 |
| (续表) | 高度范围 | 组成 | 特征 | 云类 |
| 中云族 | 下限高度2000－6000米 | 冰晶和水滴 | 灰白色无光泽 | 高积云；  高层云（连续性降水） |
| 低云族 | 下限高度2000米 | 微小水滴和雪花 | 灰黑色到黑色 | 层云和层积云；  雨层云（连续性降水）；  积云和积雨云 |

云量：天空被云遮蔽的程度，用0-10表示（大气环流特征与云量关系密切）

云量分布与纬度、海陆、气流运动关系：一般上升气流为主区域云量大，下沉气流为主区域云量小；海洋上云量高于大陆。

全球云量带：赤道多云带、纬度20°-30°少云带、中高纬多云带

|  |  |  |
| --- | --- | --- |
|  | 特征 | 平均云量 |
| 赤道多云带 | 上升气流为主；  气温高，对流旺盛 | 6 |
| 纬度20°-30°少云带 | 下沉气流为主；  空气干燥；  全球两个相对明净带 | 4，荒漠地区不足2 |
| 中高纬多云带 | 气团、锋面活动频繁；  全球高运量带 | 6.5-7 |

4.2.4大气降水

降水基本条件：雨滴下降速度超过上升气流速度；雨滴从云中降落到地面前不完全被蒸发

降水关键：雨滴必须具备相当大的尺度才能形成降水；降水形成必须经过云滴增大为雨滴、雪花及其他降水物的过程

人工降水方法：冷云人工降水：撒播干冰或碘化银等化学物质，使云中冰晶增多

暖云人工降水：撒播氯化钠、氯化钾等粉末，使其吸收水分后成为大水滴，合并其他云滴形成降水

1）降水类型：对流雨、地形雨、锋面（气旋）雨、台风雨

|  |  |  |  |
| --- | --- | --- | --- |
|  | 定义 | 特点 | 分布 |
| 对流雨 | 近地面气层强烈受热，造成不稳定的对流运动，气块强烈上升，气温急剧下降，水汽迅速达到饱和而产生对流雨。多以暴雨形式出现，并伴随雷电现象，所以又称热雷雨。 | 空气湿度高；热力对流运动强烈。 | 赤道带全年以对流雨为主。我国西南季风控制的地区，也以热雷雨为主，通常只见于夏季。 |
| 地形雨 | 暖湿气流在前进中，遇到较高的山地阻碍被迫抬升，因高度上升，绝热冷却，在达到凝结高度时，便产生凝结降水。 | 雨影区：背风侧，因水汽含量已大为减少，更重要的是气流越山下沉，绝热增温，气温升高，发生焚风效应。所以背风侧降水很少，形成雨影区。 | 地形雨多发生在山地迎风坡，世界年降水量最多的地方基本上都和地形雨有关。 |
| 锋面（气旋）雨 | 两种物理性质不同的气块相接触，暖湿气流循交界面滑升，绝热冷却，达到凝结高度时便产生云雨 |  | 由于空气块的水平范围很广，上升速度缓慢，所以锋面雨一般具有雨区广、持续时间长的特点。温带地区，锋面雨占有重要地位 |
| (续表) | 定义 | 特点 | 分布 |
| 台风雨 | 台风是产生在热带海洋上的一种空气旋涡。台风中有大量暖湿空气上升，可产生强度极大的降水。 | 台风雨和对流雨的性质比较近似，对流雨较普遍但一般强度较弱，范围较小，台风扰动剧烈且范围很大，半径可达数百千米。台风雨的产生仅限于夏、秋季，有时会造成灾害。 |  |

2）降水的时间变化

降水强度、降水量

日变化：大陆型：最大值：午后和清晨 最小值：夜间和午前

海洋/海岸型：最大值：清晨 最小值：午后

季节变化：赤道型、热带型、副热带型、温带及高纬型

降水变率： 降水变率反应了某一地区降水的稳定性或可靠性

3）降水量的地理分布

影响因子：地理纬度、海陆位置、大气环流、天气系统、地形等

湿润系数：（*p*降水量，*E*蒸发量）

降水带分布：赤道多雨带、15°-30°少雨带、中纬多雨带、高纬少雨带

|  |  |
| --- | --- |
| 赤道多雨带 | 全球降水量最多地带，年降水量至少1500mm，一般为2000-3000mm；  春分、秋分附近降水很多，夏至、冬至附近降水最少 |
| 15°- 30°少雨带 | 受副热带高压的控制，以下沉气流为主 全球降水量稀少带； 大陆西岸和内部更少，年降水量一般不足500毫米，不少地方只有100—300毫米，是全球荒漠相对集中分布地带； 某些地区由于受到地理位置、季风环流等的影响，降水很丰富：如印度境内的乞拉朋齐年平均降水量达12665mm |
| 中纬多雨带 | 温带年降水量比副热带多，一般在500—1000毫米。多雨的原因，主要受天气系统影响，即锋面、气旋活动频繁，以锋面雨、气旋雨为主；  大陆东岸还受到季风影响，夏季风来自海洋，局部地区的降水很丰富；  中纬度大陆内部因距海洋较远，空气干燥，降水量很少，分布着大面积的温带荒漠 |
| 高纬少雨带 | 因纬度高，全年气温很低，蒸发微弱，故降水量偏少；年降水量一般不超过300毫米 |

4.3大气运动和天气系统

4.3.1大气的水平运动和垂直运动

1）水平运动

风：空气的水平运动

作用于空气的力：水平气压梯度力、地转偏向力、惯性离心力、摩擦力

2）垂直运动

分类：对流运动、系统性垂直运动

4.3.2大气环流

分类：全球环流、季风环流、局地环流

1）全球环流

要点：全球气压带、行星风系、经向三圈环流

①全球气压带

分类：赤道低压带、副热带高压带、副极地低压带、极地高压带

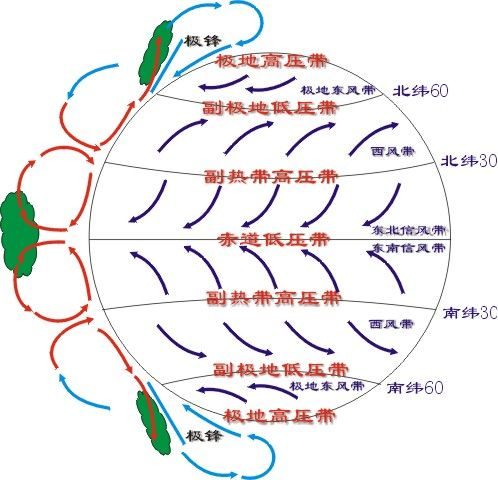
|  |  |
| --- | --- |
| 赤道低压带 | 赤道附近，终年受热，温度高，空气膨胀上升，到高空向外流散，导致气柱质量减少，低空形成低压区 |
| 副热带高压带 | 从赤道上空流向两极地区的气流在地转偏向力作用下，流向逐渐趋于纬线方向，阻滞着来自赤道上空的气流向高纬流动，空气质量增加，形成高压带 |
| 副极地低压带 | 副热带高压带和极地高压带之间是一个相对低压带 |
| 极地高压带 | 两极地区气温低，空气冷却收缩下沉，积聚在低空，而高空伴有空气辐合，导致气柱质量增加，在低空形成高压区 |

②行星风系

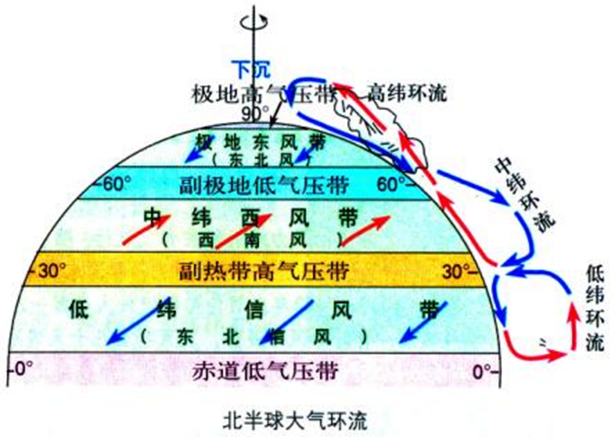
分类：信风带、西风带、极地东风带

|  |  |
| --- | --- |
| 信风带 | 南北纬300—350附近副热带高压和赤道低压之间存在气压梯度，从副热带高压辐散的一部分气流便流向赤道，因受地转偏向力的作用，在北半球形成东北风，南半球为东南风；  其位置、范围和强度随副热带高压带作比较规律的季节性变化；  由于可以预期在一定季节海上盛行的风系，称为信风，也称贸易风 |
| 西风带 | 南北纬350~600之间，因副热带高压与副极地低压之间存在气压梯度，从副热带高压辐散的气流: 一部分流向高纬度，因受地转偏向力的作用，变成偏西方向即西风；  在北半球地面风是西南风，而南半球是西北风；  西风带内吹各种方向的风，但以西风占支配地位。  西风带内，常见速度极快的气旋性风暴。 |
| 极地东风带 | 自极地高压向外辐散的气流，因地转偏向力的作用变成偏东风，故称极地东风带 |

③经向三圈环流

分类：信风环流圈、极地环流圈、中纬度环流圈

|  |  |
| --- | --- |
| 信风环流圈 | 暖空气在热带上升，到高空向高纬输送；  在地转偏向力作用下气流向东偏转，出现高空西风；  空气在副热带纬度下沉，分为两支：一支流向赤道，在低纬地区形成闭合环流，一支流向高纬；  直接的热力环流，约占30个纬度 |
| 极地环流圈 | 在极地地区，由于气温低，气流收缩下沉，气压高，气流向赤道方向流动；  极地的气流和来自副热带的气流在60度附近相遇，形成极锋；  在极锋地区气流被迫抬升，形成副极地低气压带；  抬升后气流在高空分为两支，一支向极地流动，形成极地环流。 |
| 中纬度环流圈 | 地面是在副热带纬度下沉往高纬的分气流；  高空是极锋地区被迫抬升气流的分支；  两者共同形成了一个中纬度环流圈 |



2）季风环流

定义：大陆和海洋间的广大地区，以一年为周期、随着季节变化而方向相反的风系

成因：由大尺度的海洋和大陆间的热力差异形成的大范围热力环流

分类：夏季风：夏季由海洋吹向大陆的风由暖湿热带海洋气团或赤道海洋气团构成

冬季风：冬季由大陆吹向海洋的风，由干冷的极地大陆气团构成

3）局地环流

定义：由局部环境如地形起伏、地表受热不均等引起的小范围气流

分类：海陆风、山谷风、焚风

①海陆风

定义：在滨海地区，白天风从海上吹向陆地，晚间风从陆地吹向海洋

![图片包含 物体

自动生成的说明](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4SoERXhpZgAATU0AKgAAAAgABgALAAIAAAAmAAAIYgESAAMAAAABAAEAAAExAAIAAAAmAAAIiAEyAAIAAAAUAAAIrodpAAQAAAABAAAIwuocAAcAAAgMAAAAVgAAEUYc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbmRvd3MgUGhvdG8gRWRpdG9yIDEwLjAuMTAwMTEuMTYzODQAV2luZG93cyBQaG90byBFZGl0b3IgMTAuMC4xMDAxMS4xNjM4NAAyMDE4OjEyOjA3IDIxOjQ4OjEyAAAGkAMAAgAAABQAABEckAQAAgAAABQAABEwkpEAAgAAAAMyNQAAkpIAAgAAAAMyNQAAoAEAAwAAAAEAAQAA6hwABwAACAwAAAkQAAAAABzqAAAACAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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DvhUANvw5rBvrZ7eeYTXEBx54TYtzGc7JVHo2D04ypxkYNb1ABVPUtUs9Js5Lu+nSGFByznH4D1PsKAMN/Fc7vbvHo87WtwhZVZ8XJQf8tBDg4TGD8xDdtuSAW6VZxmebUdE1SO40meDC2HWJJM53KeSgOSCuD+HSgDltM8NX8dx4fmEl5ZXVxEJZFRCsdomA3kjO7LKCUAYDcCSeUUL6gjggcg+9AGPqevG21Oz02zspby5mlAmMZGy2j6l5DzjIB2jufTrXL+I/Ht5pGsXFhBaW5WJ/LEkhYkkpCV44HLTKvB4HJ7UAbej+KoE8KWup6/d2lnJI7xuXYRpuDMABliM4A6E/U1Z8U3cQ8M3kiwi6LRZhjSQqXfquCOeDg5HPHFAHKaLYatp/jWdG1JHkWBJNRllQkOnITGcE5AOME7Cr53bwBtXV82q3cLW6I8AxLbRynEZA/5eJR/dH8C/xEZ4wCoBDhJYggje6iuXLIkhw2ov3d+PlhXjtgjAAI2hlkcMZXkuJJUlfy57iJSJLtxnEEC5+VBzk54GefvMACvciW3l+3W/lJfWQAcqxEES8YtECj5mbgE4JztOOFQdnp9/DqVmlzBuCOOjDDKe6sDyGB4IPIIoA5LX521XUbqxuJnh0Wx2LdMhJeeZhu8kAcsdpTgdd+ME4wDdGyn5LRrSLGBgxaZGR0A6NMQffAI7HEgBCbOQzq+nNJp160JEOCMxxEkme53A7iTuIVuSS3IO4rIbjWC0LW2sXMzyAraQzwxf6UeMyOFRSkQyOQQTkdyoYAlsU8OalqTyaho2nR6lMxQTPArJdYzkxyEfPjB/2hg9RgnTv7m38Lwwmy8PTzWsz7ZTpsCHyv8AaZAQSOv3QTxQBFNbNrlxbHTdbSDSoCyXNtbDDyMRjYWBBjxnoBnNb9tbQ21okFvFHFEowqIuAKAOeNhqmj6hKbCV7yynASGxY7EtXySW8zOQnJ+XBx8uAAKxbiC3n1WPVDcNd38Ya3N9GuAhY8w2yZI38MC5JKjdk8YUAtIi2Ak3SLA0K7Zp0JdbRWP+qjzkyTMSMsclmIJzlVL1jaBo9oS3a2jMkUMrZi0+M5zLIc/NK3PU+uON7MAIieaIEht2fc3nW1tMMNK2f+Pm4GBgD+FSODjjcFCI3lzQZw95DctjHG/UnHYDosAz9CP9k/OAR3URnuPtcl1MLqKTbJe2uS28f8u8Cn5WAP3twIyORuBKdNoH9oCxYaldx3E+8/dUBox2VscFvcADnp3IBpSuscbO7bVUZJrgbc3Gsz2ur3tu8s9yN+n2EnyhU6h5OPkUAgngkn1+RFALWEuLdpAz3NvcOA7IMNqLgHbGmT8sIGenBGTnaWLV7yxtbmSa5nlkiZZFW6u7GR4SSpwttCUKlyCdpPPOQMHhACSH+0NNZpIL9h9n+e5gvbgzQ26EZCNK25zKeDwSBnOD8u63YWOi6tP5fl3+m3gjWWTT47ya22q2Du8tHClT3IHJyDyCAAXbPXfDum2jfPHpkW4krdwtalz1J/eAbz6sM/Wq2qeCtP1zUH1FbqaMz/OWikyCdqAMoOVBAjQg44PzDkKQASZ0Tw3pVl4e1O7iuA6GO3gliVnmRBnAjVfmIA7Dk47kU23bRdPlfVP7DttLt1Qv9umhjgZixAwF++Cc4wwBJ6A0AQX1xcarMsTRARyJvjtJh1TJxLcD+FPSPqxGD0IWJdk0Sogluobhyyhmw+osuCZHbHywDjpwRgAFSqsADP5izO8jyrI3kz3EA2vdvzi3g7hF5BIPHPOd7Bc+QZXaVLcwRiKaaDmOzjJGLeEY+aQnAJAyTjgfItAChGgdeIrZ7eMyRxyEeVp8ZBzLIc4aVhn8yOm5mht4ZoryObTpbu2muQGW2JAa4UHJmuA6nZnPGArYwOMBUALN1HHb6rdOlyu5SZJLh0GyyDKNx54eVugz91duRjiSJFcNEkUOxlBmgtpySIQc5ubgnkseSFPJOe+SoAuEeJBFG9xHO5kijkba+oOMfvZD/DCOO2MYwMbVYZleOR5JJLlZnEU08Qw944z+5hGfljHOTnpu5+8wAIJ7eK5iuI70QGMKIbmVF3JApIxbwLjLSdBkDJOOB8qLNHd6xpztHDNDJCm6WW3vpDi0hwNitOMnd1OCG4OM4ALADhqgnurW5u/DVwNSKmRTbSx7ljBOCzMyEIf7rAdTkZBFWj4uuZrSJrHQ7p57hsWyXEscayAHlsqzkKBzu24xj1GQDM1I3eqMRf6hJJp6ymN4dPzH9pf/AJ4JyWc5BDsSFxngYJWyTs3F5I7eSBBFLNCMx2SHH7mEY5kPy9u44+6tACRqybAY4raSBDJHFIcpp8ZB/eyn+KUjPfuRnG5iIpYwxxwM6O/m21tMTumYdbm4OOBnG1e3HGcKgA0bJ48kyXkFy/JA2vqT4/8AHYFH4Eeq53jyEpLLNcu2791c3EAILHPFtbd+uQWHPB5znYAKS8TnBhtnt0EcjxgeVp0Rx+7jGPnmIwOnocfdVuk0NPL01VW0NqmSViZtzYPOWP8AeOcnk8nrQA7XYbi50K+gtCBcSwOkZJwAxUgfqa5aKKIweXl7i1mIjZ1Hz6g4H3EXPywLz3wRuJOMs4BJI7b5ZnmAx+6uLiHOVOcC2t/f+82M5x3x5a4MTlm8q0a2TBYYaPTYsdB2aZhj6AjqMBwAVCrRJHCsZT99BbzkkQgnJubgnq3UhSck++4pC9tBdCErDLOXkMtt+8KT3cm3BneQYMcYBxxjjAA+6hAGvc6p/ZrwTTWmuWbILdY7q3Cm9m/iVCMqUHPJXsckjLC/ba+NLsZol0MxRWhCFbGSNog5/wCWa5KEtkjgL1Yd+KAGXes6hJfYj02ytvKhMk93eShjaDHG5VGCT6Bx0+maRspLrUor2733l8P3llFejC26953QDCD+6n3jgbjnmMAmxHLGoVXuorhyyI5AfUXGBvcgfLAox7EY4xgOrsX855J5Jlkfyri4iGHunGcQQDPyqDuyc+vOdzgAcSUkkdpkhkhQRTTQruSyQ9IIBjmQ/Lk4yTg4+4oVcoVBSO1ktkLxxysGj0+M5/eSnOGlIz3PUjJG5mAGors0MUcDMGbzba3mzukbvc3BxwM/dX6cZwEQbJVBDSXMFy+QVHz6k/r/ALMCj3wR32/fANm8028u55JP9H2wuDaxNkoG4JlcD7zAk4Xpx1BORD/Y0oDxEpPAf3jiRsNdzespxgIMD5QCOgwAMEAF0W5M37+5DNcjN5MpIkkA+7En9yMZPQ55OeSWLf7FuiY5GeGG4b90zw5xbQ9fKi44zgZbgnAOPlUKAOOj3S7TB9mheMlLRBlkt0PDSDI+aUgnk8DJHdizf7FnjysXkmOLEkEUrMRJL186ZurMCeF6ZGc5xtACXQ5CGilkWaGTDzB2Ia8lPaQgcRjA+UdRwRgEM5tJuSD59yuZgTeTx5Vyo6RR/wBxOTznPXuxYACJpF1EIyrwQysPKXyuFtIR/BCMY3HAyxx9MALSf2JcR4kiNunkEpaRtlo4AT80pHV5Dk8n1IzyxIAsmiygEDy5I4mEkUczk+fOcHzJiBzg4wo4GAey7Xf2FM5aOWRZopAHuWc/PdP2RuMLEP7o65IPGd4An9i3knzTTKss67bqWJiGVOvkxf3V9W4bj1IKn9kXYIkSS3gmJ8qLyx8tpFz/AKsEYLkDqQB7EDBAEGj3EEf7jyESH5LSGRmdVyRulc9Xk6nk/jklq2dOtVsrfyA7yMCWaSRss7Hkk/j2HAGAAAAKAKep2lxqDxwSOgsPvSqCQ0p7ITjhPXHXkHjOaX9i3b7WlmVZZF2TPExBhi/55Q/3Qe75DHHb5dgAHRbobGjeCKSNvLtwgPl2kWCNyLjDSEcZPTPoCGU6LPGuI1txHbOPskcm5l3k8zS93fJJx685ydwAEOhy7WjJSaE/vWErfNdz46ynHCjAAUDHsAACo0W4aVvOuA5n/wCP2bkPL2WJR/BGM9Ac9ecksQBq6PeMVleWKG4dfLd4s/6PCP8AlnCMYGeMtwTgccKFc2kXe5ZI/s8MkTmO1VclLZCSDIAR80pUnk8DJA43FwA/sO4iRhCIDHAwe3jlZm3y8HzpW6swPQe2c5xta2iOsbxSSLPCyiWcSMQ15L/00bHEYwPlAOemNo2sAPOi3TECedS1xlryePKuwHSNP7kfJ6HPU/eYtTF0e7UR7ZIIZH/cDys4tIR/BCCOpwMscZ4OMBVAAo0i5jG+L7OnkNttIyS0cAP3pSMZeQ5PX1wOrEodGm2EqYnhixNEkrH9/N182bA5IPRegwD1C7QB39gyuzRTMk0Ug33LO2Gun7I3GFiH90Zzkg8Z3Kuj3khSSW4US3A/0qZCd4XtFF/cX1brx6ncoB//2QD/4THoaHR0cDovL25zLmFkb2JlLmNvbS94YXAvMS4wLwA8P3hwYWNrZXQgYmVnaW49J++7vycgaWQ9J1c1TTBNcENlaGlIenJlU3pOVGN6a2M5ZCc/Pg0KPHg6eG1wbWV0YSB4bWxuczp4PSJhZG9iZTpuczptZXRhLyI+PHJkZjpSREYgeG1sbnM6cmRmPSJodHRwOi8vd3d3LnczLm9yZy8xOTk5LzAyLzIyLXJkZi1zeW50YXgtbnMjIj48cmRmOkRlc2NyaXB0aW9uIHJkZjphYm91dD0idXVpZDpmYWY1YmRkNS1iYTNkLTExZGEtYWQzMS1kMzNkNzUxODJmMWIiIHhtbG5zOnhtcD0iaHR0cDovL25zLmFkb2JlLmNvbS94YXAvMS4wLyI+PHhtcDpDcmVhdG9yVG9vbD5XaW5kb3dzIFBob3RvIEVkaXRvciAxMC4wLjEwMDExLjE2Mzg0PC94bXA6Q3JlYXRvclRvb2w+PHhtcDpDcmVhdGVEYXRlPjIwMTgtMTItMDdUMjE6NDc6MjUuMjUzPC94bXA6Q3JlYXRlRGF0ZT48L3JkZjpEZXNjcmlwdGlvbj48L3JkZjpSREY+PC94OnhtcG1ldGE+DQogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAg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②山谷风

分类：山风（夜间）、谷风（白天）

成因：山坡升温快、降温也快

谷风 山风

③焚风

成因：气流受山地阻挡被迫抬升．迎风坡空气上升冷却，起初按干绝热直减率降温(1 0C ／ 100m)，空气温度达到饱和状态时，按湿绝热直减率降温(0.5-0.60C／100 m)，水汽凝结，产生降水。

气流越山后顺坡下沉，空气中的水汽含量大大减少，下沉气流按干绝热直减率增温，以致背风坡气温比迎风坡同高度气温高，湿度也小的多，从而形成相对干热的风，这就是焚风。

特征：无论冬夏昼夜，山区都可能出现焚风；

焚风效应对植被类型与生态特征、成土过程和土壤类都有一定影响；

我国西南山区表现显著

4.3.3主要天气系统

天气：一定区域短时间内大气状态（冷暖、风雨、干湿、阴晴等）及其变化的总称

天气系统：大气中引起天气变化和分布的各种尺度的大气运动系统。各种天气系统都具有一定的空间尺度和时间尺度，而且各种尺度系统间相互交织，相互作用。

1）气团

定义：在广大区域内水平方向上温度、湿度、铅直稳定度等物理属性较均匀的大块空气团

形成条件：大范围性质比较均匀的下垫面；比较静稳的环流条件

性质：大气中的热量和水分主要来自下垫面，因而气团属性由下垫面决定

气团变性：在气团移动过程中，由于下垫面性质的改变和大范围空气垂直运动状况的变化，气团物理属性及其天气特点也随之改变

分类：暖气团：温度高于下垫面，一般含大量水汽，容易形成云雨天气

冷气团：温度低于下垫面，一般形成干冷天气

2）锋

定义：温度或密度差异较大的两个气团相遇形成的狭窄过渡区域

锋线：锋与地面的交线

特点：锋远比气团小，可看作两个气团的界面；

锋面两侧气象要素有明显差异，常形成广阔云系和降水天气；

锋附近等温线特别密集，是确定锋线的重要标志

图片包含 地图, 文字

自动生成的说明

分类：冷锋、暖锋、准静止锋、锢囚锋

|  |  |
| --- | --- |
| 冷锋 | 冷气团主动向暖气团方向移动的锋 |
| 暖锋 | 暖气团主动向冷气团方向移动的锋 |
| 准静止锋 | 很少移动或移动速度非常缓慢的锋 |
| 锢囚锋 | 如果冷锋移动速度快，追上了前方暖锋，或者两条冷锋相遇，并逐渐合并起来，使地面完全被冷气团所占据，原来的暖气团被迫抬离地面，锢囚到高空，这种由两条锋面相遇、合并后形成的锋 |

3）气旋和反气旋**（不考）**

①气旋

定义：由锋面上或不同密度空气分界面上发生波动形成的，占有三度空间、中心气压比四周低的水平空气涡旋

分类：温带气旋（锋面气旋）：产生于极锋上

热带气旋：产生于赤道锋上

气旋的天气特征：既有气团天气，也有锋面天气；

锋面气旋中的上升气流，有利于云和降水的形成：

气团湿度大：易发生降水

气团干燥：形成薄云

气团层结稳定：产生层状云系和连续性降水

气团层结不稳定：有利于对流发展，产生积状云和阵性降水

有冷暖锋：前方为暖锋云系及连续性降水，后方为冷锋云系及阵性降水

②反气旋

定义：是占有三度空间，中心气压比四周高的大型空气涡旋

特征：气流运动由中心向四周旋转运动，旋转方向在北半球为顺时针，南半球为逆时针；

反气旋水平尺度比气旋大。

天气特征：反气旋范围内没有锋面，中心多出现下沉气流，故天气晴好

分类：根据温压结构：冷性反气旋（冷高压）、暖性反气旋（暖高压）

根据生成地区：极地反气旋、温带反气旋、副热带反气旋

4.4气候的形成**（不考）**

4.4.1气候和气候系统

天气：某一地区在某一瞬时或某一短时间内大气中气象要素和天气现象的综合。天气过程是大气中的短期过程。

气候：在太阳辐射、下垫面性质、大气环流和人类活动长时间作用下，某一时期内大量天气过程的综合。不仅包括该地多年来经常发生的天气状况，也包括偶尔出现的极端天气状况。

4.4.2气候的形成

影响因素：辐射因子、环流因子、地理因子

辐射因子：由太阳辐射能在地球表面时空分布及其变化引起，呈现纬度地带性和季节性

环流因子：不同环流形势下，形成不同气候类型，具有纬度地带性

环流变异：厄尔尼诺与南方涛动

地理因子：由下垫面性质决定

海陆分布对气候影响：破坏温度的纬度地带性分布，出现大陆性气候和海洋性气候

洋流对气候影响：调节南北气温；影响东西两岸气温；影响寒暖流，从而影响降水

地形对气候影响：对太阳辐射、空气湿度、土壤温度、大气水分和降水都有影响

4.4.3气候带和气候型

分类：低纬度气候、中纬度气候、高纬度气候、高地气候

§海洋和陆地水

5.1地球水循坏与水量平衡

5.1.1地球上水的分布

5.1.2水分循环和水量平衡

水分循环

蒸发：海陆表面的水分因太阳辐射蒸发进入大气；

降水：在适宜条件下水汽凝结发生降水，大部分直接降落在海洋中，形成海洋水分与大气间的内循环；

降落到地面，出现三种情况：

①通过蒸发和蒸腾返回大气；

②渗入地下形成土壤水或潜水；

③形成径流汇入河流，最终回到海洋。

水量平衡

定义：对任意选择的区域（或水体）在任意时段内蓄水量变化值=收入水量-支出水量

水量平衡三个重要环节：降水量、蒸发量、径流量

全球水平衡状况：全球水量保持平衡，基本上长期不变；

海洋是大气水分和陆地水的主要来源；

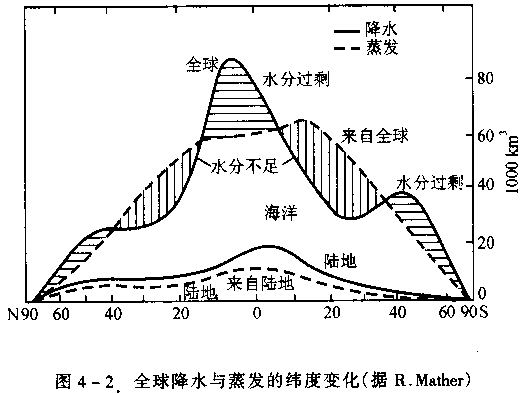
大陆气团对陆地降水的作用远远不及海洋气团的作用；

海洋和陆地水最后通过径流达到平衡：

海洋蒸发量大于降水量；

陆地降水量等于陆地蒸发量与入海径流量之和；

陆地上的蒸发量小于降水量。



全球降水与蒸发的纬度变化

5.2海洋起源与海水理化性质

5.2.1海洋的起源

海洋起源假说：①洋壳是原生的②泛大陆分离时海底扩张形成洋壳③熔融岩浆侵入地壳并溢出地表冷凝，因密度大，其下伏地壳沉入上地幔，形成洋壳

海水假说：来自地壳和上地幔

5.2.2海洋的构成

洋：远离大陆，不受大陆影响，具有稳定理化性质、潮汐系统及洋流系统

四大洋：太平洋、大西洋、印度洋、北冰洋（按面积从大到小）

海

定义：毗邻大陆的，深度浅，面积小，兼受大洋和大陆影响，理化性质较不稳定，潮汐现象明显，具有独立海流系统的水域

分类：边缘海：位于陆地边缘的海 陆间海：地中海、内陆海

5.2.3海水的组成**（不考）**

化学成分：H、O为最主要元素

盐度：海水中全部溶解固体与海水重量之比，常以每千克海水中所含克数表示

氯度：每千克海水含氯的克数

5.2.4海水的温度、密度和透明度

1）温度

决定因素：海水的热量收支状况

主要热量来源：太阳辐射、大气对海面的长波辐射、海面水汽凝结、暖于海水的降水、大陆径流、地球内部向海水放出的热能

主要热量消耗：海面蒸发、海面向空气的长波辐射、海面与冷空气的对流热交换

变化：季变化：取决于太阳辐射的季变化，季风和洋流也有一定影响

日变化：取决于太阳辐射的日变化

2）密度：约为1.022-1.028g/cm3

3）颜色和透明度**（不考）**

颜色：取决于海水对太阳光线的吸收和反射状况（红橙紫在20m内被吸收，绿黄蓝深入更深，极少量蓝光可深入1000m以上）；浮游生物以及泥沙也能造成海水颜色变化

透明度：以直径30cm的白圆盘投入海水中的可见深度表示。影响因素有：悬浮物质、颜色、浮游生物、海水涡动、入海径流、云量

5.3海水的运动

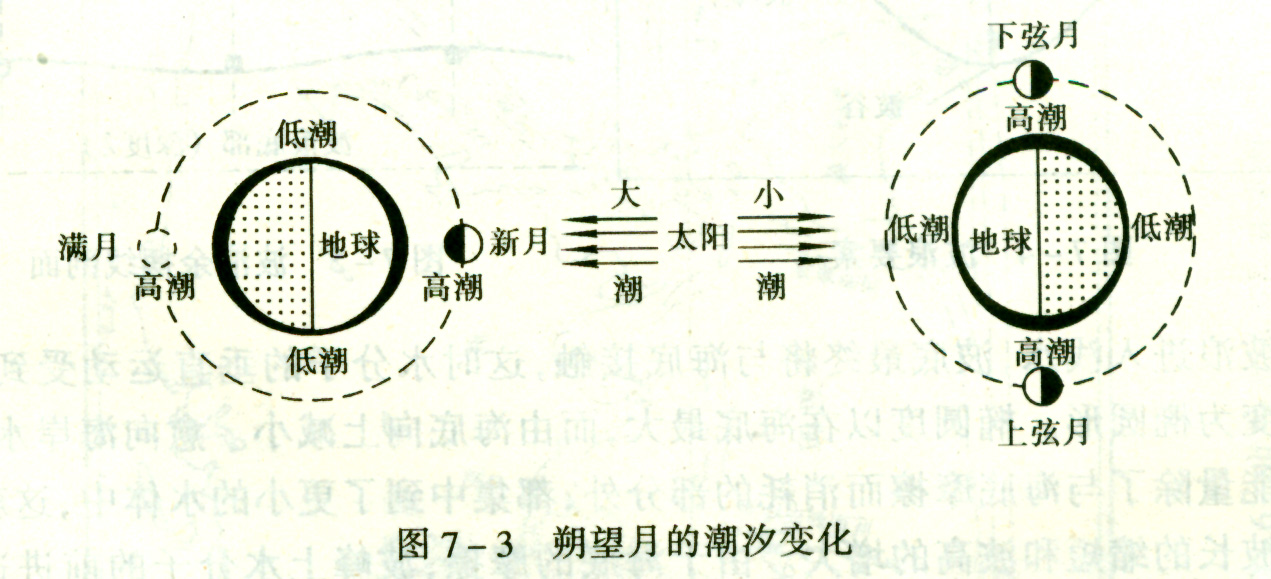
5.3.1潮汐与潮流

潮汐：由月亮和太阳引力引起的海面周期性升降现象

和潮汐相关的概念：涨潮、落潮、高潮、低潮、潮差（高潮与低潮的差）

潮差变化规律：以朔望月为周期变化

大潮：潮差最大时 小潮：潮差最小时

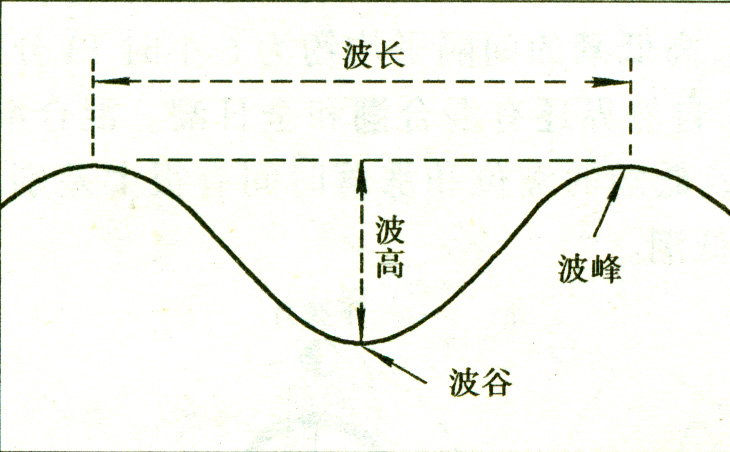


潮流：海水受月球和太阳的引力而发生的周期性流动

5.3.2海洋中的波浪

波浪：海水质点以其原有平衡位置为中心，在垂直方向上作周期性圆周运动的现象

波浪要素：波峰、波谷、波长、波高



5.3.3洋面流和水团运动

洋流：海水沿着一定的方向有规律的水平运动

洋流主要动力：风力、地转偏向力、海陆分布、海底起伏

洋流影响：对自然地理成分，尤其是对气候发生巨大的（非直接的）影响；

许多沿海地区的温度和降水状况都与附近的洋流有关

分类：按成因：摩擦流：摩擦流、风海流；重力-气压梯度流：倾斜流、密度流；潮流

按温度：暖流、冷流

|  |  |  |
| --- | --- | --- |
| 摩擦流 | 摩擦流 | 盛行风对水面摩擦力的作用，以及风在波浪迎风面上所施的压力，迫使海水向前运动；  海水开始运动后，受到科里奥利力的影响，流向与风向不一致：在北半球海水表面流向偏于风向右方45°，在南半球偏左45°，偏角随着深度增加而增加，但流速随深度的增加而减小；  到某一深度处，流速只为表面流速的1/23，这个深度称为摩擦深度。 |
| 风海流 | 从海面到摩擦深度的海水运动 |
| 重力-气压梯度流 | 倾斜流 | 因风力作用、陆上河水流入或气压不同，导致海面形成坡度，引起海水流动 |
| 密度流 | 由于海水温度和盐度的差异，使得温度不均匀，海面发生倾斜而造成的海水流动 |
| 潮流 | 潮流 | 海水受月球和太阳引力发生的周期性流动 |

大洋表层洋流模式及主要环流：亚热带环流、亚极地环流、赤道环流



亚热带环流 亚极地环流 赤道环流

大洋水团及其洋流

水团：大洋中具有特别温度和盐度值的，性质相同的大团水体

分类：以深度划分：表层水团、中心水团、中层水团、深层与底层水团

5.4海平面变化**（不考）**

5.4.1七万年来海平面变化

5.4.2近百年的海平面变化

5.4.3二十一世纪海平面上升预测

总体呈上升趋势

5.5海洋资源和海洋环境保护**（不考）**

5.5.1海洋资源

海洋资源：与海水本身有着直接关系的物质和能量（化学元素、海洋生物、海底矿藏、海水运动产生的能量、贮藏在海水中的热量）

5.5.2海洋对地理环境的影响

1. 地理环境基本要素
2. 生命摇篮
3. 海洋生态系统
4. 太阳能的主要接收者和蓄积者
5. 借助于大气物质能量交换过程间接影响气候并受气候影响

5.5.3海洋环境保护

限制入海污染物、适当安排生产和资源开发

5.6河流

5.6.1河流、水系和流域

河流：在重力作用下，集中于地表凹槽内的经常性或周期性的天然水道

水系：由河流综合沿途很多支流形成的复杂的干支流网络系统

流域：河流或水系从一定的陆地面积上获得水分补给的部分陆地

水系形式：一定的岩层构造、沉积物性质和新构造应力场的反应。通常分为树枝状、格状、长方形

河流的纵横断面：能够反应河流比降的变化。

相关概念：总落差：河源与河口的高度差 落差：某一河段两端的高度差 比降：单位河长的落差

影响河流纵断面的因素：流域内岩层的性质、地貌类型的复杂程度、河流的年龄

河流的分段：河源（全流域海拔最高）、上游（多急滩和瀑布）、中游（纵断面往往呈平滑下凹曲线）、下游（多浅滩和沙洲）、河口（河流入海、入湖或更高级河流）

5.6.2水情要素

|  |  |
| --- | --- |
| 水位 | 定义：河流中某一标准基面或测站基面上的水面高度。  水位高低是流量大小的主要标志 |
| 流速 | 定义：水质点在单位时间内移动的距离。  影响因子：纵比降方向上水体重力的分力与河岸和河底对水流的摩擦力之比。 |
| 流量 | 定义：单位时间内通过某过水断面的水量。  流量变化会引起流水蚀积过程等特征值的变化和水位的变化 |
| 河流的温度 | 影响河流温度主要因素：河流的补给特征、时间、流程远近 |

5.6.3河川径流

1）径流的形成和集流过程

长时间连续降水典型模式：停蓄阶段、漫流阶段、河槽集流阶段

2）径流变化

年内变化：汛期、平水期、枯水期、冰冻期

年际变化：由降水量的年际变化引起，常以径流的离差系数来表示年径流的变化程度

3）特征径流

洪水径流：水位超过一定高度，给城市或村庄带来灾害的径流。（补给方式：连续的强降水）

枯水径流：一年内没有洪水时期的径流。（补给方式：地下水）

5.6.4河流的补给

补给形式：降落在地表的雨水、冰川、积雪、地下水、湖泊和沼泽

不同补给方式特点：

|  |  |
| --- | --- |
| 降水补给 | 与季节有密切关系 |
| 融水补给 | 与积雪量和气温变化有关，通常发生在春季 |
| 地下水补给 | 稳定、均匀；  深层地下水通常没有季节变化，浅层地下水与河流水位有直接关系 |
| 湖泊与沼泽补给 | 取决于湖泊和沼泽对水量的调节作用 |
| 人工补给 | 将湖泊水引入河流、废水排放 |

5.6.5流域的水量平衡

流域水量平衡的原理：进入任意流域空间的水量，减去所消耗的水量，等于它原来的绝对增加值

意义：可利用流域水量平衡的原理把进入某一流域的各种水量来源进行比较，确定各自对水量情势的影响程度

5.7湖泊与沼泽

5.7.1湖泊

定义：地面洼地积水形成较为广的水域

形成条件：地貌条件：湖盆 物质基础：水

当地貌条件与物质资料不匹配时，会出现①巨大的封闭盆地却缺水（塔里木盆地）②拥

有足够水量而盆地地形缺乏封闭性，以至于不能发育较大湖泊（四川盆地）

湖盆的形成

|  |  |
| --- | --- |
| 构造湖 | 一部分地壳断陷、下沉形成 |
| 火山湖 | 死火山口或熔岩高原的喷口形成 |
| 冰川湖 | 冰蚀洼地中冰碛丘陵间或终碛后方 |
| 堰塞湖 | 山崩、熔岩流或冰川阻塞河谷形成 |
| 风蚀湖 | 风蚀盆地积水形成 |
| 岩溶湖 | 岩溶作用形成 |
| 潟湖 | 浅水海湾（或海港）被沙堤（或沙嘴）与海水分隔开来形成 |
| 牛轭湖 | 河流曲流裁曲取直后形成 |
| 热融湖 | 多年冻土区地下冰融化后，地表下陷积水形成 |

湖泊的分类

|  |  |
| --- | --- |
| 按湖水来源 | 海迹湖（里海、东钱湖）、陆面湖 |
| 按湖水与径流关系 | 内陆湖（青海湖）、外流湖 |
| 按湖水存在时间 | 间歇湖、常年湖 |
| 按矿化程度 | 淡水湖、咸水湖（碳酸盐湖、硫酸盐湖、氯化物盐湖） |
| 按温度状况 | 热带湖、温带湖、极地湖 |

湖水性质

1）颜色：浅蓝、青蓝、黄绿、黄褐色

影响因素：含沙量、泥沙颗粒大小、浮游生物种类和数量

2）透明度

影响因素：太阳光线、湖水含沙量、温度、浮游生物

3）温度

获取热量主要方式：太阳辐射热量、水汽凝结潜热、有机物分解产生的热、地表传导的热

热量损耗主要方式：湖水向外辐射和蒸发

4）化学成分：

各种元素的含量存在较大的差异

湖泊水文特征

湖水的运动：定振波、湖流

定振波：全部湖水围绕某一个或几个重心而摆动的现象，称为定振波

定振波和波浪区别：定振波不只是水面，而是整体水分子都在运动；整体水面一侧上升，另一侧下降；摆动作用力消失后，摆动仍可延续一些时间

湖流产生原因：由河流注入的湖，河流入口处的水面比外泄处略高，造成湖水发生单向缓慢流动；风的作用使湖水随湖面风向运动；定振波造成水面倾斜后，湖水在重力作用下发生湖流；水温变化造成湖水的垂直循环

5.7.2沼泽

定义：比较平坦或稍微低洼而过度湿润的地面

特性：存在各种喜湿植物及泥炭层

物质组成：水（85-95%）、干物质（5-10%，主要是泥炭层）

形成条件：主要为水分条件。过多水分引起喜湿植物的侵入，土壤通气状况恶化，在生物作用下形成泥炭层

形成过程：水体沼泽化、陆地沼泽

5.8地下水

定义：地壳岩石裂缝或土壤空隙中的水，埋藏于地表以下的各种状态的水

5.8.1水在岩石中存在的形式

气态水、吸着水、薄膜水、毛管水、重力水、固态水

5.8.2相关概念

饱水带：重力水在重力作用下向下运动，聚积于不透水层之上，这一带岩石的所有空袭都充满水分，这一带岩石称饱水带

包气带：饱水带以上的部分，除存在吸着水、薄膜水、毛管水外，大部分空隙充满空气，称包气带

潜水面：包气带和饱水带之间的界限

5.8.3地下水的分类

按埋藏条件分：上层滞水、潜水、承压水

按储存空隙的种类（含水层性质）分：孔隙水、裂隙水、岩溶水

1）上层滞水

定义：存在于包气带中局部隔水层之上的重力水

分布范围：补给区与分布区的范围基本上一致

主要补给来源：大气降水和地下水

主要耗损形式：蒸发和渗透

特点：分布不广；上层滞水接近地表；受气候、水文条件影响较大；水量不大，季节变化强烈

2）潜水

定义：地表下第一个稳定隔水层上具有自由表面的重力水

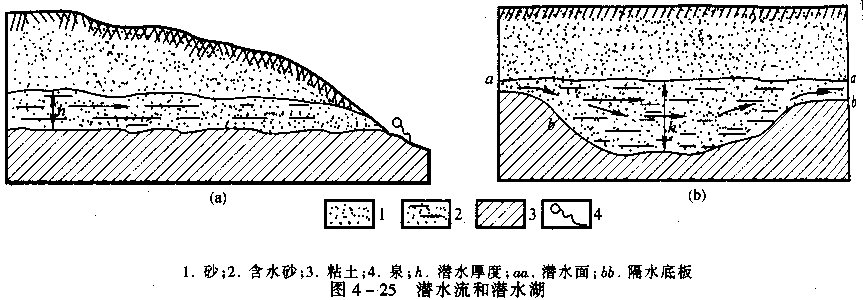
埋藏深度：从地表到潜水面的距离

含水层：潜水面到下伏隔水层之间的岩层。隔水层就是含水层的底板，潜水层以上通常没有隔水层

潜水的补给：大气降水、凝结水、地表水

特性：大多数潜水的补给区和分布区是一致的；具有明显的纬度地带性和垂直地带性特征

潜水流和潜水湖



潜水和河流互相补给关系

图片包含 文字, 地图

自动生成的说明

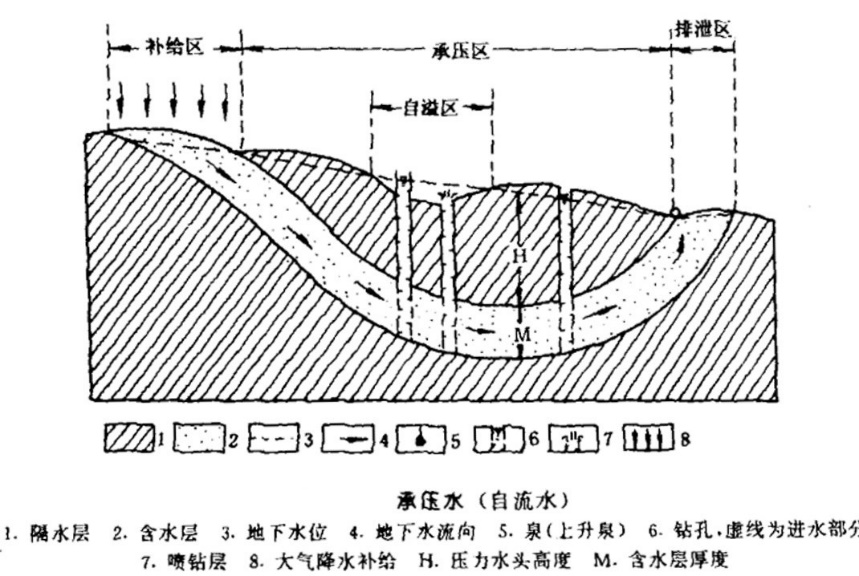
3）承压水

定义：充满于两个隔水层之间的水

自流水：承压水水头高于上部隔水层（隔水顶板），在地形条件适宜时，其天然露头或经人工凿井喷出地表的水

特性：隔水顶板妨碍了含水层直接从地表得到补给，故自流水的补给区和分布区常不一致

承压水示意图



三者之间的关系示意图

图片包含 地图

自动生成的说明

5.9冰川

5.9.1冰川类型

冰川：发生在陆地上，由大气固态降水演变而成的，通常处于运动状态的一种天然冰体

特点：随气候变化而变化，但不是在短期内形成或消亡

发生冰川必要条件：雪线触及地面。（冰川时极地气候和高山冰雪气候的产物）

类型：山岳冰川、大陆冰川、高原冰川、山麓冰川

|  |  |  |
| --- | --- | --- |
|  | 分布 | 特点 |
| 山岳冰川 | 主要分布于中低纬山区，由于雪线较高，积累区不大，因而冰川形态受地形的严格限制 | 按形态可分为：悬冰川、冰斗冰川、山谷冰川 |
| 大陆冰川 | 目前只发育在两极地区  著名大陆冰川：南极和格陵兰岛的冰川 | 由于面积和厚度都很大，冰流不受下伏地形影响，自中央向四周流动，冰流下常掩埋巨大的山脉和洼地 |
| 高原冰川 | 冰岛的伐特纳冰帽面积达8410平方千米 | 是大陆冰川和山岳冰川的过渡型。冰川覆盖在欺负缓和的高地上，向周围伸出许多冰舌 |
| 山麓冰川 | 著名的山麓冰川：阿拉斯加的马拉斯冰川 | 由数条山谷冰川在山麓扩展汇合成为的广阔冰原。山麓冰川是山岳冰川向大陆冰川转化的中间环节 |

5.9.2冰川对地理环境影响

对极地和中低纬高山冰川区的影响：规模较小的冰川，只对附近地区的气候发生影响；巨大的冰川（如南极和格陵兰冰盖）对广大地区甚至全球气候发生影响

对气候的影响：冰盖的扩展增强了地球的反射率，促使地球进一步变冷，并影响气团性质和环流特征

对地球水圈的水分循环中的作用：冰盖消融量的增减，直接影响海平面的升降

对植被及土壤的影响：冰川推进，将毁灭其覆盖地区的植被，动物被迫迁移，土壤发育过程亦将中断。自然地带将相应向低纬和低海拔地区移动；冰川退缩，植被、土壤将逐渐重新发育，自然地带相应向高纬和高海拔地区移动

对地表形态的影响：冰川的侵蚀和堆积作用显著改变地表形态，形成特殊的冰川地貌

§地貌

6.1地貌成因与地貌类型**（不考）**

6.1.1地貌成因

构造运动、气候因素、岩性、人类活动

6.1.2基本地貌类型

正地貌：构造隆升与外力剥蚀的结果

负地貌：构造沉降与外力堆积的产物

类型：山地、平原

（1）山地

定义：是山岭、山间谷地和山间盆地的总称，是地壳上升背景下由外力切割而成

形态要素：山顶、山坡、山麓

按绝对高度分类：极高山（>5000m），高山（3500~5000m），中山（1000~3500m），低山（<1000m）

（2）平原

定义：一种广阔、平坦、地势起伏很小的地貌形态类型

特点：都不是严格的几何平面；内部经常包括许多次级地貌类型

分类：按海拔高度：低平原（<200m）、高平原

按表面形态特征：平坦平原、倾斜平原、凹形平原、起伏平原

按外动力差别：熔岩平原、喀斯特平原、冲积平原、海成平原

6.1.3地貌在地理环境中的作用

导致地表热量的重新分配和温度分布状况复杂化；

改变了降水量分布格局；

对生物界的影响；

对自然界地域分异的影响；

对土地类型分化的影响；

6.2风化作用与块体作用

6.2.1风化作用

定义：地表岩石与矿物在太阳辐射、大气、水及生物作用下理化性质发生变化，颗粒细化、矿物成分改变，从而形成新物质的过程

意义：剥蚀的先驱；对地貌的形成、发展与地表夷平起着促进和推动作用

（1）类型

物理风化（机械分化或崩解）：岩石由整体破裂为碎屑、裂隙、孔隙和比面积增加，物理性质发生显著变化而化学性质不变的过程

化学风化：岩石在大气、水与生物作用下发生分解而形成化学组成与性质不同的新物质的过程

生物作用：生物在风化中除机械的破坏作用外，对化学风化也起很重要的作用；

生命活动过程中产生的氧和二氧化碳，是化学风化中的两个重要反应剂；

植物通过根的分泌与吸收，促进周围矿物的分解及元素的迁移；

残体和排泄物经微生物的分解转化形成的各种具有高度化学活性的可溶于水的化合

物，加速了化学风化的进行。

（2）风化壳

风化产物：风化作用的残留矿物、次生矿物及可溶性物质的统称，是土壤形成的物质基础，某

些风化产物还可形成风化矿床。

风化壳（残积物）：经风化与剥蚀而依然残留原地覆盖于母岩表面者的风化产物。

堆积风化壳：被搬运后再堆积的风化产物。

6.2.2块体作用与重力地貌

定义：岩体和土地在重力作用及地表水地下水影响下沿坡向下运动

分类：崩落、滑落、蠕动

（1）崩落与崩塌地貌

定义：陡坡上的岩体与土块在重力作用下突然快速下移，称为崩落或崩塌

发生条件：坡度陡，相对高差大，或具有外倾结构面，或处于断层破碎带、侵入岩体接触带；

风化作用强；

降水或地下水引起坡体变化，地表水冲刷坡麓等导致岩体、土体失稳的情况，松散堆

积物坡度超过休止角。

形成的地貌：山坡上部的崩塌崖壁：坡度大，常表现为悬崖峭壁

坡麓的岩堆（倒石堆）：呈半锥状，上部岩块较细，下部岩块很大

（2）滑落与滑坡地貌

滑落：由岩石、土体或碎屑堆积物构成的山坡体在重力作用下沿软弱面发生整体滑落的过程

产生条件：由重力引起的下滑力超过软弱面的抗滑力

必须具备一定的内在因素和诱发因素

坡体滑落因素：内在因素：地层岩性、地质构造、坡体结构、有效临空面

诱发因素：降水强度、地下水、地震、地表径流对坡麓的冲淘、坡面加积作用、人为在坡地上蓄水灌溉建房筑路时破坏坡地稳定性

（3）蠕动

定义：主要是土屑蠕动，是坡面上的岩屑、土体在重力作用下，顺坡发生极缓慢移动的现象

产生原因：土层中冻结与融解、干与湿和温度等因素的变化，导致坡地上的土屑时涨时缩，在

胀缩过程中，受重力的作用，使土屑向坡地下方逐步移动

主要出现地点：15°~30°的坡地

作用结果：平常不易察觉蠕动，但经过相当长的时间后，可以发现碎屑层或土层发生弯曲，斜坡上的物体发生变形

6.3流水地貌

定义：由地表流水作用侵蚀、搬运、堆积塑造的各种地貌

6.3.1流水作用

流水作用：侵蚀作用、搬运作用、堆积作用

影响因素：流速、流量、含沙量

三者关系：当流速、流量增加，或含沙量减少时，产生侵蚀作用，并将侵蚀下来的物质运走（搬运作用）；相反就发生堆积

6.3.2坡面流水地貌与沟谷流水地貌

地表流水分类：坡面流水、沟谷流水、河流

（1）坡面流水地貌

坡面流水：雨水或冰雪融水直接在地表形成的薄层片流和细流，出现的时间很短，被冲刷下来的物质，称为江河泥沙的主要来源

坡积物：坡面流水冲刷下来的物质，或汇入沟谷和河流，或在缓坡、坡麓与洼地堆积下来，称为坡积物

坡积裙：坡麓堆积围绕着山麓接连地成片分布时，形似衣裙，称为坡积裙

（2）沟谷流水地貌

沟谷水流的形成：坡面细流顺坡而下时，流速、流量加大，并转变为线状集流，形成冲刷能力增强的沟谷水流。

沟谷的分布：与岩性、气候、植物等因素有关。

沟谷的特点：规模短小，总剖面上陡下缓，多陡坎、壶穴，横剖面多呈V形。

（3）泥石流

定义：在山区突然爆发，历时短暂，含有大量泥沙和石块等固体物质，并具有强大破坏力的特殊洪流

主要地貌类型：泥石流沟谷、泥石流扇

形成条件：固体松散物质储备丰富，例如坡面与沟谷流域内有厚层风化壳、黄土、坡积物与块体运动堆积物；

坡面坡度与沟谷纵比降较大。以重力作用为主，土体失稳且供给量大的重力坡，有滑坡

活动或冲刷严重的侵蚀坡，纵比降较大且具有土质沟床的沟谷，最有利于泥石流形成；

可从高强度降水或冰雪融水获得充足的水源供给。

6.3.3河流地貌

分类：

|  |  |
| --- | --- |
| 根据河谷的横剖面 | 谷底：包括河床和河漫滩；  谷坡：常发育成阶地。 |
| 根据河谷的纵剖面 | 上流河谷：狭窄，常见瀑布；  中流河谷：较宽，常见河漫滩和阶地；  下流河谷：多曲流和汊河；  河口：三角洲和三角湾。 |

（1）河谷的发育

河谷定义：是以河流作用为主，并在坡面流水与沟谷流水参与下形成的狭长形凹地，是一种常见地貌形态。

河谷组成：谷坡：位于谷底两侧，其发育过程受河流作用，坡面岩性、风化作用、重力作用、坡面流水及沟谷流水作用等影响。

谷底：形态因地而异，山地河流的谷底仅有河床，平原盆地河流谷底则发育成河床和河

漫滩。

（2）河床与河漫滩

河床：指河流平水期河水占据的河槽。

河漫滩：指洪水时期被洪水淹没的河床侧旁的谷底部分，是一种冲积平原或泛滥平原。

a）深槽与浅滩

深槽：位于河段的弯段 浅滩：位于河段的过渡段

深槽与浅滩的分布：由于水流的侵蚀与堆积作用的交替进行，深槽与浅滩也是交替分布的。山区河流中深槽与浅滩的分布同时受岩性和构造的影响，在岩石软弱或破碎处容易发育成深槽

图片包含 文字, 地图

自动生成的说明b）边滩与河漫滩

形成过程：

形成小边滩：在弯曲河床的横向环流的作用下，凹岸及其岸下

河床发生侵蚀并形成深槽，岸坡亦因崩塌而后退。侵蚀物被底

流带到凸岸形成小边滩。

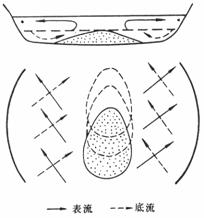
形成大边滩：小边滩促进环流作用，随河谷拓宽而不断发展成

为大边滩。

形成河漫滩：汛期大量悬移物质堆积于大边滩上，细粒悬移质

（即河漫滩相冲积物）如粉沙、粘土和亚粘土覆盖于粗粒推移质

（即河床相冲积物）之上，形成二元结构，边滩发展为河漫滩。

c）心滩与江心洲

复式环流：由于河床横剖面形态多不规则，水流往往被河床地貌分离成

两股或数股主流线。

心滩的形成：往往与复式环流作用有关。在河底受两股相向的底流作用

的地段，被流水推移的泥沙就在那里堆积下来，逐渐形成心滩。

江心洲的形成：心滩继续堆积淤高，并高出中水位以上，洪水泛滥时，

在顶部可盖上悬移质泥沙，便成为江心洲。

（3）三角洲

a）河口三角洲

定义：河流注入海洋或湖泊处，常形成平面上呈三角形的堆积体，称三角洲。

按三角洲形态特征分类：

鸟足状三角洲：如美国的密西西比河三角洲；

尖头状三角洲：如西班牙的埃布罗河三角洲；

扇形三角洲：如非洲的尼罗河和尼日尔河三角洲。

多岛型三角洲：如湄公河三角洲。

b）洪积扇

定义：暂时性或季节性洪流在山谷出口处形成的扇形堆积地貌。

主要分布：多分步在干旱或半干旱地区。

形成过程：往往由多次洪流过程形成；洪流流出谷口后，比降显著减小，水流分散、下渗和蒸发；流量大减，携带的物质大量堆积下来，形成扇形堆积体

（4）河流阶地

定义：谷底因河流下切而抬升到洪水位以上并呈阶梯状分布于河谷两侧

组成：阶面：原有谷底的遗留部分

阶坡：由河流下切形成

阶地高度：阶面与河流平水期水面的高差

分类：按组成物质与结构分为：侵蚀阶地、堆积阶地、基座阶地

（5）河谷类型与河流劫夺

a）河谷类型

河谷：河水所流经的带状延伸的凹地。

类型（根据河谷发育与地质构造关系）：顺向河谷、次成河谷、逆向河谷、先成河谷、叠置河谷

b）河流劫夺

定义：一条河流溯源侵蚀导致分水岭外移，进而占据相邻河流流域的过程。

6.3.4准平原与山麓面

准平原：在湿润气候条件下，地表经长期风化和流水作用形成的接近平原的地貌形态。

山麓面：在干旱半干旱气候条件下，坡面洪流不断搬运风化碎屑而致山坡大体保持原有坡度平行 后退，山体逐渐缩小时在山麓形成的大片基岩夷平地面。

6.4喀斯特地貌（岩溶地貌）

6.4.1什么是岩溶地貌

名称由来：喀斯特岛闻名于石灰岩的溶蚀和侵蚀形成的奇特地形，喀斯特成为石灰岩岩溶地貌现象的专用名词，1966年我国第二次喀斯特会议后改名为岩溶

定义：地下水与地表水对可溶性岩石溶蚀与沉淀，侵蚀与沉积，以及重力崩塌，坍陷、堆积等作用形成的地貌。

岩溶作用：地下水和地表水对可溶性岩石所产生的作用。

岩溶作用的过程：化学过程、物理过程

（1）化学过程

（2）物理过程

流水作用：侵蚀、沉积

重力作用：崩塌、坍塌、堆积

6.4.2岩溶地貌的主导因素

（1）岩性与构造条件

Q1：哪类岩石容易发生岩溶作用？

卤化物盐类、硫酸盐类、碳酸盐类：石灰岩（方解石）白云岩（白云石）泥灰岩（含有大量不溶解粘土）

Q2：哪类地质构造中容易产生岩溶作用？

石灰岩地层节理发育地区、地台区、石灰岩地层区域性的断裂带

（2）水动力条件

干旱和寒冷地区：雨量小、水流活动性差

湿热气候区：雨量丰富、地表水和地下水流量大，流动快

6.4.3不同的岩溶地貌的形成

溶洞

钙化的岷山式喀斯特地貌：（钙化：湖泊、河流或泉水所形成的以碳酸钙为主的沉积物）

黄龙：彩池群、瀑布、滩流

九寨沟：岩溶洼地堰塞湖、瀑布、滩流

典型地貌：长海、五花海、树正群海、珍珠滩、犀牛滩、树正瀑布、诺日朗瀑布

6.5冰川与冰缘地貌

6.5.1冰川地貌

冰川作用：冰川在中对地表进行侵蚀并将侵蚀物在地表堆积下来的过程

冰川作用的分类：

|  |  |
| --- | --- |
| 拔蚀作用 | 当冰床底部或冰斗后背的基岩，沿节理反复冻融而松动，若这些松动的岩石和冰川冻结在一起，则当冰川运动时就把岩块拔起带走，这称为拔蚀作用。 |
| 磨蚀作用 | 当冰川运动时，冻结在冰川或冰层底部的岩石碎片，因受上面冰川的压力，对冰川底床进行削磨和刻蚀，称为磨蚀作用。 |
| 冰楔作用 | 在岩石裂缝内所含的冰融水，经反复冻融作用，体积时涨时缩，而造成岩层破碎，成为碎块，或从两侧山坡坠落到冰川中向前移动。 |

冰蚀地貌：冰斗、U型谷、悬谷、羊背石……

6.5.2冰缘地貌（冻土地貌）

冻土：凡处于零温或负温，并含有冰的各种土或岩

寒土：温度状况相同但不含冰的土

6.6风沙地貌与黄土地貌

6.6.1风沙作用

|  |  |
| --- | --- |
| 风蚀作用 | 吹蚀：风吹地面，由于风压力和气流紊动作用而引起沙粒吹扬。  磨蚀：起沙风通过所挟带的沙粒，对地面进行磨蚀，如对岩石表面发生摩擦和在孔隙中的旋磨。  起沙风：当风力达到使沙粒移动的临界速度时的风。 |
| 搬运作用 | 起沙风挟带沙粒运动。 |
| 风积作用 | 当风力减弱或风沙流前进遇到障碍物使风速减小时，可以使沙粒发生堆积。 |

6.6.2风沙地貌

风蚀地貌——风棱、风棱石、风蚀柱、风蚀蘑菇、风蚀洼地、风蚀盆地、风湿残丘、雅丹地貌

雅丹地貌：形态与风蚀残丘近似；由蚀余松散土状堆积物；如河湖相地层形成的一类特殊风蚀残丘。

雅丹地貌形成原理：经长期风蚀，由一系列平行的垄脊和沟槽构成。

典型：甘肃敦煌雅丹地貌

风积地貌**（不考）**

6.6.3黄土与黄土地貌**（不考）**

6.7海岸与海岸地貌

潮间带：位于高、低潮间，高潮时淹没，低潮时出露

6.7.1海岸地貌

典型：夏威夷海滩、马来西亚海滩

6.7.2海蚀地貌

典型：台湾野柳海蚀地貌、海南天涯海角

6.7.3海底地貌**（不考）**