



**COAL &**



**PETROLEUM**

A book by Career Avenues

As per IIT-JAM Syllabus  
GEOLOGY / EARTH SCIENCE



# **COAL AND PETROLEUM**

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**Weightage of the chapter based on competitive exams**

<b>GATE Year</b>	<b>Weightage (Marks)</b>
2019	SAMPLE
2018	
2017	
2016	
2015	
2014	
2013	
2012	
2011	
<b>Average</b>	
<b>NET Year</b>	
2019 June	
2017 December	
2016 December	
2014 December	
<b>Average</b>	
<b>JAM Year</b>	
2019	
2017	
2016	
2015	
<b>Average</b>	

## Chapter 1: COAL

### 1.1.Introduction :

Coal is a compact rock formed from compressed and stratified sedimentary rocks.

Coal is formed by the action of pressure, temperature and time. The degree of development of coal varies from peat at the lowest rank to anthracite at the highest rank.

SAMPLE

Coal is a compact rock formed from compressed and stratified sedimentary rocks. The degree of development of coal varies from peat at the lowest rank to anthracite at the highest rank.

### 1.2.Origin

There are two theories regarding the origin of coal.

#### 1.2.1. The swamp theory

According to this theory, coal is formed at the bottom of a swampy forest.

Coal is formed at the bottom of a swampy forest.

At first, the vegetable matter is accumulated in the forest. Now the vegetable matter is submerged underwater as the land starts to sink. With time the sinking rate of land increased which results in burial of the vegetable matter covered by large quantities of sand and mud. So there is no time for decomposition and destruction of matters. This stage is followed by uplifting in years.

This is a rapid process.

This is a rapid process.

Evidence of this theory is as follows:

i. In swamps, the vegetable matter is accumulated.

ii. Tree trunks are found in coal seams.

iii. The composition of coal varies.

iv. There is no uniformity in the thickness of coal seams.

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#### 1.2.2. Drift theory

According to this theory, coal is formed from drift material.

Drift material is transported by water and deposited in a swampy area.

are formed from drift material.

sediments.

All Indian coals are of this type.

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1. Coal composition is not uniform and shale bands are found associated sometimes.
2. Fossil tree trunks are found.
3. The bands are not uniform in thickness.

### 1.3.Coalification

The formation of coal is called coalification.

#### 1.3.1.Bio-chemical

This is the formation of coal from plant material and hydrocarbons under pressure with 75-90% water.

#### 1.3.2.Physical

The biochemical grades from lignite and H<sub>2</sub>O. The types that anthracite c

SAMPLE

### 1.4.Peat formation

The peat is formed from plant material as lignin, cellulose, resins, etc. As the peat is a porous, fibrous humic substance, hence the formation of peat is known as humification.

The conditions for peat formation are

- The
- Th

#### Peat land :

Peat formation

- C
- n
- T

SAMPLE

### 1.5.Types of coal

Coal is broadly divided into the sapropel

#### 1.5.1.Humic

The coals which are formed from plant material is divided into

##### 1.5.1.1.Vitrinite

this band is brittle and is a microlithotype vitrite mainly.

**1.5.1.2.Clarain :** This band occurs as fine laminations and lustre lies in between vitrain and durain bands. The microlithotypes associated with clarain band are vitrite, clarite, durite, fusite and trimacerite.

**1.5.1.3.Durain :** It is grey to black in color with dull lustre. The microlithotypes are durite and trimacerite.

**1.5.1.4.Fusain :** Fusain occurs as lenses and it is soft and friable in nature. Fusain disintegrates into fibrous powder.

### 1.5.2.Sapropelic coal :

Sapropelic coal has a lustrous appearance and is found in boghead coal.

#### 1.5.2.1.Cannel coal

Cannel coal is a type of coal and black.

#### 1.5.2.2.Boghead coal

This is for boghead coal may grade.

### 1.6.Ranks

Ranks refer to the degree of metamorphism.

Rank is based on the increase in the amount of volatile matter is present.

The coal is classified into anthracite.

**Peat:** Peat is a type of coal.

It is used as fertilizer as it contains a large amount of nitrogen and also used in the manufacture of briquets. The calorific value is very low for peat so it is not so economic.

**Lignite:** it is also known as brown coal because of its characteristic brown color.

Lignite is a good fuel because of its calorific value and very prone to combustion. It is exclusively used for power generation, besides lignite is used for manufacture of producer gas and coke.

**Bituminous**

defined by its calorific value, electric power, high volatile matter, and for low volatile matter.

**Anthracite**

residential use.

The other ranks are

#### 1.6.1.Pro

Coal rank

Peat

Lignite

Sub-bituminous

Bituminous

Anthracite

### 1.6.2. Grade of coal

Grading of Indian coal is based on calorific value and ranges from A to G.

Grade	Calorific value(kCal/kg)
A	>6200
B	5600 – 6200
C	4940- 5600



D	4200- 4940
E	
F	
G	

D, E and

### 1.7. Cleat

The frac  
these cle

#### 1.7.1.Ty

There ar

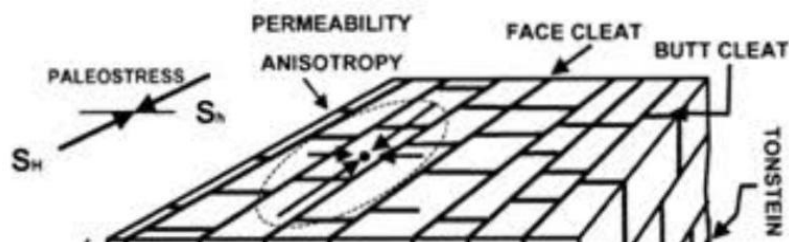
SAMPLE

esence of  
gularly.

l seam.  
r to face

oal seam,

v. distinguished on a  
microscopic scale.



SAMPLE

#### 1.7.2.Im

The cleat  
When co  
content.  
temperat  
developed  
becomes le

cite coal.  
he carbon  
ssure and  
tures are  
intensity

The cleats have importance in coal exploration such as :

- The direction of pillar and gallery of underground mining is determined by cleats.
- Cleats give permeability of coal seams.

iii		is preferred as
<b>1.8.Micro</b>	<div data-bbox="683 495 903 551" data-label="Text"> <p>SAMPLE</p> </div>	
<b>1.8.1.Def</b>		
The sma physical liptinite a		Based on huminite,
<b>1.8.2.Div</b>		
<b>Vitrinite</b> walls of vitrinite vitrinite with incr it becom The refle reflectance of oil generation.	<div data-bbox="683 1294 903 1350" data-label="Text"> <p>SAMPLE</p> </div>	ose of cell ated with ctance of e change sing rank ormation. 0.8-0.9% ative of end
<b>Liptinite :</b> Liptinite is from hydrogen rich plant materials such as spores, resins, cuticles etc. Liptinite is important because it defines the coalification jump based on its sporinite reflectance.		
<b>Inertinite :</b> T originates is again s		reactive. This inertinite
Group		
Vitrinite		
Litinite		
Inertinite		
		Funginite
	Macerals lacking plant cell structure	Secretinite
		Macrinite
		Micrinite
	Fragmented inertinite	Inertodetrinite

## 1.9.Microlithotypes :

### 1.9.1.Definition :

Association of

### 1.9.2.Classif

Classification

present, for e

combination

eral is

hand,

ively.

Microlithotype	SAMPLE			pe
Vitrite				
Liptite				
Inertite				
Clarite				
Durite				
Vitrinertite				
Duroclarite	Vitrinite	Liptinite	Inertinite	
Clarodurite	Inertinite	+ Liptinite	+ Vitrinite	

## 1.10.Combustion properties of coals :

### 1.10.1.Calorific v

combustion of

value.

**Gross calorific**

produced durin

**Net Calorific**

combustion of

The GCV and

NCV = GCV

Where NCV a

H= hydrogen

M= Moisture

ated by

Calorific

heat

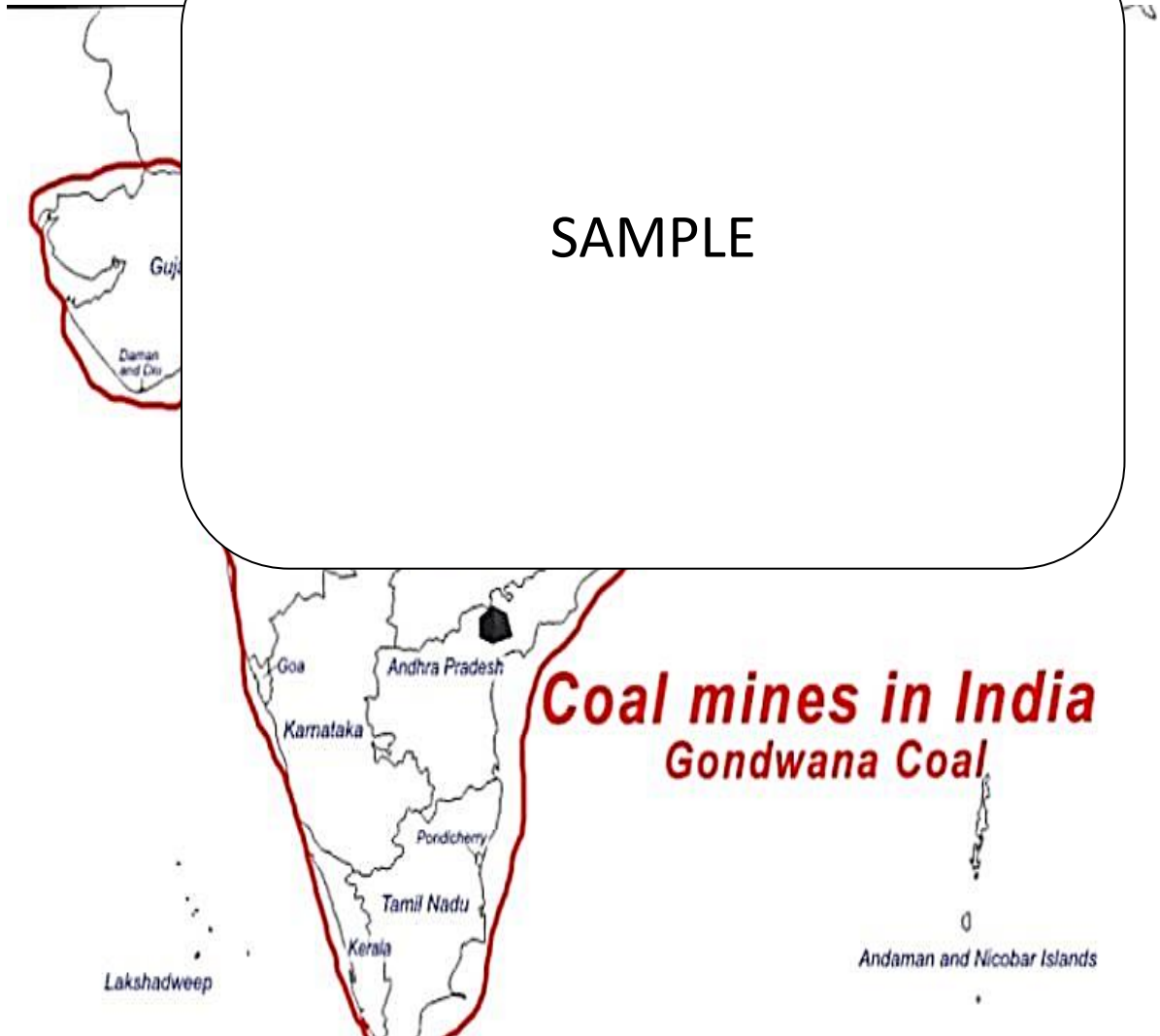
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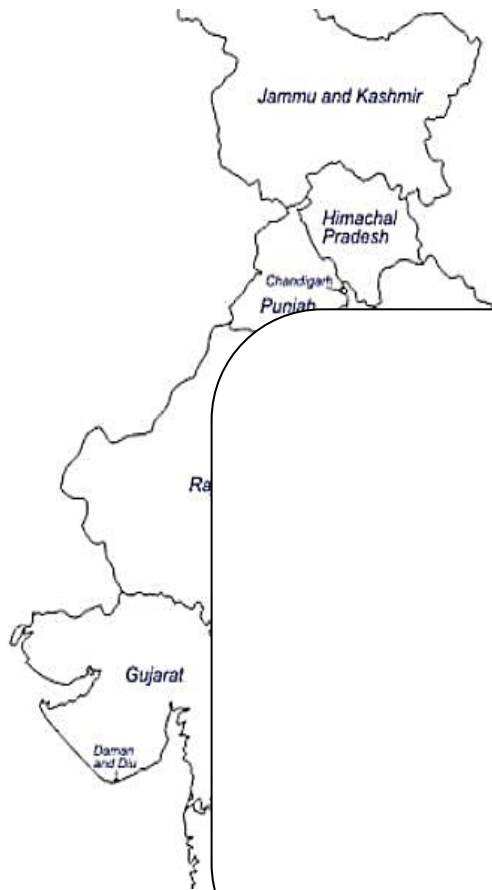
### 1.11. Geologi

State or Union territory	SAMPLE			
Andhra Pradesh	Godavari Valley	Ramagundam-Mantheni area, Indaram-Jaipuram area Wardha Valley Eluru-Rajamundri	" Tertiary (Eocene)	
	Palar Basin		Tertiary (Miocene-Pliocene)	

Arunachal Pradesh	Assam Basin	Namchik-Namphuk	Tertiary (Oligocene-
Assam	SAMPLE		
Chhattisgarh			
Gujarat			
	”	Guneri, Trambau	Cretaceous
Jammu and Kashmir		Kalakot, Metka, Mahogala Chakkar, Jangalgali, Chinkah	Tertiary
Jharkhand		Ramgarh, West Bokaro	Permian
Kerala	SAMPLE		
Madhya Pradesh			
Meghalaya			
Nagaland			
Orissa			
Rajasthan		Kapurdi, Khari, Gura Bithnok, Palana	Tertiary (Eocene)
Sikkim		Rangit Valley	Permian
Tamil Nadu	Cauvery Basin	Neyveli, Bahur	Tertiary (Eocene)
	Palar Basin		

			Tertiary (Miocene- Pliocene)
Uttar Pradesh		Singrauli	Permian
West Bengal			





## **Coal mines in India**

### ***Tertiary Coal***

SAMPLE

## Multiple choice questions

### Level 1 ( Easy questions)

1. Coal rank is

- a) The way
- c) Quality

2. The Ne

- a) Kankar
- b) Lower
- c) The up
- d) Bhuj f

3. The co

- a) Const
- b) Long
- c) Rise o
- d) Rise o

4. Most o

- a) Talchir for
- c) Jabalpur series
- d) Maharashtra series

5. which one of the followings is a Tertiary coalfield ?

- a) Jharia
- b) Korba
- c) Palana
- d) Gondwana

### Level 2 (Q

1. The

- a) 196
- c) 136

2. the

- a) low
- c) Hig

3. Car

- a) It h
- b) It i
- c) Du
- d) All

4. Ter

- a) Jam
- c) Rajasth

5. Neyveli lignite deposits are associated with

- a) Tertiary rocks
- b) Gondwana rocks
- c) Quaternary rocks
- d) Mesozoic rocks

**Level 3 (Difficult questions)**

1. The vitrinite macerals contain

- a) oxidized plant materials
- b) cell wall of vascular plants
- c) Spores

2. Char

not be

a) Gra

b) Gr

c) Cha

d) Cha

raphite does

SAMPLE

**Level**

1. Bitu

a) Ney

c) Sin

2. Bro

wood

a) Anth

c) Lignite

original

3. The age of most of the Bituminous coal seams in India is

- a) Silurian
- b) Miocene
- c) Carboniferous
- d) Permian

4. Dur

a) Lig

c) Bit

5. In

a) Par

c) Ne

SAMPLE

6. Ma

Group

P. Co

Q. Co

R. Oi

S. Ur

a) P-4,

c) P-1, Q-3, R-4, S-5

7. In which of the following localities does coal deposit occur?

- a) Dariba
- b) Kudremukh
- c) Wardha
- d) Rudrasagar



8. Which of the following lithostratigraphic units hosts lignite at Neyveli?

- a) Ariyalur Formation
- b) Ghatil Formation
- c) Kamalpur Formation
- d) Neyveli Formation

9. The

- a) peat
- b) peat
- c) peat
- d) lignite

10. W

- a) Bar
- c) Cu

11. Co

- a) Ney
- c) Pal

#### Level 5

1. Which of the following is the fundamental constituent of humic coal? (JAM 2019)

- a) Mineral matter
- b) Maceral
- c) Lithotype
- d) Kerogen

2. Match the f

Group I

P. Uraniu

Q. Lignit

R. Bitum

S. Petrol

a) P-4, Q

c) P-3, Q

3. Gondv

a) fixed c

c) iron

4. The ma

is (GATI

a) less th

c) 15-20%

5. Choose th

A) Sapropelic coal is a potential source of oil

B) Vitrinite reflectance value should be >1 for lignite sample

C) H/C content of vitrinite group is more than that of liptinite maceral group

D) In Ranigaunj field, coal seams alternate with limestone quality

a) A

b) B

c) C

d) D

## Answers

### Level 1

- 1.b. Coal rank  
2.c. Neyveli  
3.d. Both t  
4.b. Most which  
consists of n from  
bottom to nigaunj  
formations  
5.c. Palana

### Level 2

- 1.a. The kr  
2.d. The cl (%) and  
high fixed), high  
volatile(30  
3.d.  
4.d. Tertiary but 3500  
million tonne, Assam,  
Madras (Neyve  
5.a. Neyveli lignite deposits are associated with Cuddalore formation of Tertiary age.

### Level 3

- 1.b. Vitrinite is a coal maceral which formed from woody materials such as lignin and cellulose  
of cell walls  
2.c. Charcoal which the  
atoms of rcoal and  
thermally e because  
of highly

### Level 4

- 1.c. Gond  
2.c. Lign (%).  
3.d. As he age is  
Permian.  
4.c  
5. d. Jhar  
6.d. Coal  
Copp  
Oil -  
Uran  
7.c  
8.b  
9.a. With From bio-  
chemical to  
10. a,b,c. The akar formation  
of Gondwana and in Barail group of Assam also.  
11.b.

**Level 5**

1.b. Mac

2.b. Ur

La

Bi

Pe

3.d

4.a. Wit

increas

less i.e.

5. a. Sa

Vitrinit

**Numer**

1. 2g ai

matter

**Explanati**

1. Given, total coal content = 2g

Moisture content = 0.2g

Ash content = 0.3 g

Vol

Miner

Volat

Vola

SAMPLE

on content  
t would be

the volatile

SAMPLE