GCE MARKING SCHEME

SUMMER 2019

GCE (LEGACY)
GEOLOGY - GL5 (OPTION 2)
1215/02

INTRODUCTION

This marking scheme was used by WJEC for the 2019 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE GEOLOGY - GL5 (LEGACY)

OPTION 2

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1. (a) 5150 m (accept 5050 - 5250 m) (1)

(b) (i) $8.7 \times 10^{10} + 3.6 \times 10^{8}$ m^3 (1) = 8.74×10^{10} m^3 (1)

(ii) microplankton accumulate as source rock deposits (1) hydrocarbons migrate from source rock (1) moves through permeable reservoir rock (1) buoyant in water (1) stopped by impermeable cap rock (1) stratified by density (1) unconformity trap (1). Max (3)

(iii) Variations in permeability (1) variations in viscosity of crude oil (1) fluid pressure in the reservoir (1) development of secondary permeability (1). Max (2)

(c) (i) Oil & gas can be formed from marine kerogen (1) oil and gas can form at the same temperatures (1) the source rocks were heated to between 10 and 140°C (1). Max (2)

(ii) coal as source rock (1) produces methane as part of maturation (1) terrestrial type of kerogen (1) reference to formation below depth of the oil window (1) reference to the unconformity indicating that we cannot determine the previous burial depth (1). Max (2)

(d) Large volume pore space in Permian sandstones (1) permeable Permian sandstone (1) faults permeable (1) natural trap already stored gas (1) deep enough to maintain pressure on CO_2 (1) self-sealing cap rock (1)

However: offshore location increases engineering problems (1) and expense (1)
Holistic answer. Max (3)

Total [15]

2. Igneous processes – related to cooling and solidification of magma/lava and pyroclastic activity

Processes (case studies) one or more (breadth versus depth) of:
- magma segregation (cumulate/gravity settling)
- pegmatitic
- hydrothermal
- black smokers
- porphyry copper

Description of processes with links to the actual minerals being formed: e.g chromite, cassiterite, galena, sphalerite, chalcopyrite etc
Description of concentration of metallic elements in igneous rocks

Evaluation
Igneous process can form and concentrate metalliferous minerals however, other processes can also form and concentrate such ore minerals – surface processes/sedimentary part of the rock cycle. Weathering and residual deposits, placer deposits, evaporites, supergene enrichment.

Total [25]

3. (a) Swamps, plant material, hot and wet - maximum vegetation growth. Warm - luxuriant growth

Fresh water - vegetation (indicated by freshwater bivalves), tropical. Quiet - material not swept away.
Stagnant - rotting not complete.
Sinking - continued deposition.

Rapid burial, exclude oxygen/anaerobic, minimise rotting.
Burial raises temperature and pressure conditions.
Time factor.
Coalification proceeds from partially decomposing vegetable matter such as peat, through coal rank - lignite, bituminous coals to the highest grade of anthracite.

During this process, the percentage of carbon increases, and volatiles and moisture are gradually eliminated.

Total [25]

(b) General - The appropriate method depends upon the geometry and physical properties of the resource. Evaluation involves advantages and disadvantages of technique. Case study examples credited.

(i) geological mapping
Field work based – direct observation using trained geologists.
Uses base maps/satellite or aerial imagery

Advantages:
High level of accuracy to pinpoint resources at the surface prior to exploitation
Can be very detailed – good to assess problems of exploitation and viability of resource Samples can be collected for accurate analysis

Disadvantages:
Labour intensive and time consuming Structural trends obscured on small scale Accuracy depends upon sample points and interpretation Possible problems of access in remote areas and lack of outcrops

(ii) geophysical methods
Seismic surveying
seismic /explosions / land / ship / reflection / record of 2-way time / graphical representation to identify structures

Magnetic Surveying
magnetometer / land / plane / ship / graphical representation of magnetic readings / depends on changes in magnetic properties or distribution of rocks i.e. structures / anomalies, iron deposits

Gravity Surveying
gravimeter / changes in gravity / changes in density of the underlying rocks / reflects the rocks / minerals / structure(s) / graphical representation / anomalies. High density metal minerals

Electrical surveying
Resistivity & conductivity of metalliferous deposits

Evaluation:
Advantages: speed / accuracy / cheap?
Can locate hidden resources at depth

Disadvantages: depends on target / cost?
Cannot prove existence of deposit
Only one stage in the exploration process

(iii) satellite remote sensing

Radiation is absorbed and reflected in different ways by different materials (rocks, soils and vegetation)
Materials emit different types of radiation depending upon temperature and chemistry

Reflected radiation of several wavelengths (some in visible spectrum), and displayed as a visual image.
Suitable for major metalliferous deposits (e.g. copper, iron).

Advantages:
Provides a large scale image relatively cheaply without need of fieldwork
Inaccessible areas studied easily Large scale structures show up which might be missed in the field. Satellites are generally in place – only need to buy image required

Disadvantages:
Used for only basic reconnaissance. Colours can be misleading
None of the advantages of mapping

Must evaluate for full marks.

Total [25]

4. Answer depends upon chosen examples of raw materials.
Suggestions - coal extraction by deep mining/open cast
salt extraction by brine pumping/underground mining
onshore oilfield development
quarrying for roadstone / aggregate
sand and gravel extraction
Metal mining
China Clay extraction
Other examples are acceptable

Evaluation:
N.B. For access to full marks must **evaluate** the problems.

Potential environmental problems e.g. Noise, dust, pollution of water courses by chemical/waste, waste disposal etc.
And the ways by which these may be minimised e.g. restricted blasting, baffle banks, settling tanks, backfill etc.
How significant are the problems and the way(s) that they are minimised?
Case studies to show planning to satisfy local or national legislation for max levels of pollution.