

HARROW SCHOOL



ENGLISH SCHOLARSHIP EXAM 2021

1½ hours

Instructions:

- This paper is in two sections worth equal marks; you are advised to divide your time evenly between the two.
- In both responses you will be marked for the quality of your writing (spelling, grammar and punctuation).
- Please begin your response to Section B on a new piece of paper.

SECTION A: WRITING

Imagine that your school is considering whether to close down the school library, instead changing to online books and e-readers only. If this change went ahead, students would all have an e-reader and could download books, articles, newspapers, and magazines when they wished. However, there would be no physical books and no library building.

Write an article for your school magazine, arguing either for or against this change.

Marks will be awarded for clarity and accuracy of writing, imaginative and thoughtful use of English, originality of thought and evidence of an ability to think critically and reflectively.

[25 marks]

SECTION B: READING

Remember to start this response on a new sheet of paper!

Read the following excerpt from *The Foundling* by Stacey Halls and answer the question that follows.

The road was wide and lively even at that time, and we'd pass crossing sweepers and delivery carts and sleep-soaked wives queuing outside bakeries with their bread for the ovens, and messengers bouncing between the river and the coffee houses with news from the water. The traffic thickened towards the bridge, and the masts in the wharves bobbed and drifted beyond the sheds crowding the river's edge. Men making for the quays and piers yawned, still half-dreaming of their beds and the warm women they'd left there. Even though it was black as pitch – here and there oil lamps burned above some doorways, but in the November fog they were like pale little suns behind heavy cloud – Abe and I knew the way with our eyes shut.

We passed the Butchers' Hall and moved down towards the river, which lay low and glittering before us, already choked with hundreds of vessels bringing fish, tea, silk, spices and sugar to the various wharves. The going was steep this way, and not easy in the dark. When the clock struck five a few minutes after we arrived, the porters would begin shoring in, moving baskets of fish from the boats in the hithe to the stalls. From six, the city's fishmongers and costermongers and innkeepers and fish fryers and servants would descend with barrows and baskets to haggle over the price of three dozen smelt or a bushel of oysters or a great fat sturgeon, moving up in price as the sellers came down, meeting somewhere in the middle. The sun would rise, weak and watery, so the cries of the merchants – 'Cod, alive, alive-oh!' and 'Had-had-had-haddock,' and 'Getcher smelt, flounder, shad, gudgeon, dace,' with a low and deep emphasis on the last word – were no longer disembodied, but belonged to the red-cheeked merchants and their wives. Each cry was as distinctive as the next, and I knew without looking who had called it.

There was a kind of magnificence to Billingsgate, to the morning sun on the creaking masts in the hithe, the iron-necked porters with four, five, six baskets piled on their heads, sliding through the crowds. By seven o'clock the ground was a churning mass of mud, studded all over with fish scales like glittering coins. The stalls themselves were a jumble of wooden shacks with leaning roofs that dripped icy water down your neck in winter. Willow baskets lay bursting with stacks of silver sole and crawling crabs, and handcarts groaned with shining shoals. There was Oyster Street in the wharf, called for its row of boats parked nose to tail, piled high with grey, sandy shells. Or if it was eels you were after, you had to get a waterman to take you out to one of the Dutch fishing boats on the Thames, where curious-looking men with fur hats and jewelled rings balanced over great tureens of the serpent-like creatures, writhing and stirring in their murky broth.

Then there were the Billingsgate wives, porpoises in petticoats, with their fat red hands and prow-like bosoms pushing through the crowds, shrieking like gulls. They carried flasks of brandy to nip in the cold months, and wore gold hoops at their ears. I decided from an early age I would not become one of them, would not marry a Billingsgate boy for all the shrimp in Leigh.

Explore the way the writer presents the energy and atmosphere of the city.

Be sure to use quotations from the passage in your response.

[25 marks]



HARROW SCHOOL

French Scholarship Examination 2021

60 Minutes

- *Section 1 : Text and reading comprehension*
- *Section 2 : Text and retranslation*
- *Section 3 : Translation into French*
- *Section 4 : 30-word responses in French*

*Write your answers on the question paper using blue or black ink.
Ensure that you write your name on the paper !*

Name _____

1. Read the passage. Find the English expressions, below, and write them in French, exactly as they are in the text. You will be penalised for incorrect spelling and missed accents.

Ce que j'ai pu attendre dans ces cafés... Très tôt le matin quand il faisait nuit. En fin d'après-midi à la tombée de la nuit. Plus tard, à l'heure de la fermeture...

Le dimanche soir, une vieille automobile de sport noire – une Jaguar, me semble-t-il – était garée rue Championnet, à la hauteur de l'école maternelle. Elle portait une plaque à l'arrière : G.I.G. Grand invalide de guerre. La présence de cette voiture dans le quartier m'avait frappé. Je me demandais quel visage pouvait bien avoir son propriétaire.

À partir de neuf heures du soir, le boulevard était désert. Je revois encore la lumière de la bouche du métro Simplon, et, presque en face, celle de l'entrée du cinéma Ornano 43. L'immeuble du 41, précédant le cinéma, n'avait jamais attiré mon attention, et pourtant je suis passé devant lui pendant des mois, des années.

• Example : On Sunday evening **Le dimanche soir**

1. From 9pm _____
2. It seems to me _____
3. Almost opposite _____
4. It bore a plate _____
5. At closing time _____
6. I wondered _____
7. At nightfall _____
8. In the area _____
9. What I could expect _____
10. When it was dark _____

(10 marks)

2. Read the translated sections of text. Adapt the original language to complete the translation. Check verb forms, singular / plural nouns and adjectives etc.

- Example

Le boulevard était désert : the boulevard was deserted

→ The boulevards were deserted :

Les boulevards étaient déserts

1. *Une vieille automobile de sport noire* : an old black sports car

→ A new white sports car :

–

2. *Je revois encore la lumière* : I still see the light

→ He still sees the lights :

–

3. *Je suis passé devant lui* : I passed in front of it

→ He passed in front of me :

–

4. *Une voiture était garée* : a car was parked

→ Two cars were parked :

–

5. *L'immeuble n'avait jamais attiré mon attention* : the building had never attracted my attention

→ The buildings had always attracted my attention :

–

(15 marks)

3. Translate the sentences into French using the verb provided:

a) I get up. (se lever)

–

b) They attend the concert. (assister à)

–

c) You (tu) have taken the bus. (prendre)

–

d) It was warm. (faire)

–

e) Jeanne has left. (partir)

–

f) You (vous) must work hard. (devoir)

–

g) I had already eaten. (manger)

—

h) We are going to stay here. (aller)

—

i) They will sing well. (chanter)

j) She does not drink much. (boire)

—

(30 marks)

4. You are writing an article in French for your school website talking about your house.

You will mention 1) a description of your house ; 2) helping at home ; 3) a recent enjoyable activity at home ; 4) how you would like to change your house ; 5) where you intend to live when you are older and why.

Answer in the spaces provided. Aim to write 30 words per question. Do not exceed 180 words in total (focus on accuracy rather than quantity) – 40 marks.

1. Décris ta maison!

2. Que fais-tu normalement pour aider à la maison?

3. Comment t'es-tu amusé récemment à la maison ?

4. Comment voudrais-tu changer ta maison ?

5. Où vas-tu habiter à l'avenir et pourquoi ?



HARROW SCHOOL

Geography Scholarship Examination 2021

60 Minutes

*Section 1 and 2 consist of short and medium length questions.
Answer all questions in the space provided.*

*Section 3 consists of a choice of 4 essays. Answer **one** question on the
examination paper in the space provided.*

*You are advised to spend 15 minutes on section 1, 15 minutes on section 2
and 30 minutes on section 3.*

Clearly name any extra paper used.

Use blue or black ink for written text.

You may use a pencil for diagrams.

You may use a calculator

QUESTION 1

Answer ALL of QUESTION 1

[spend 15 minutes on this section]

Use **Figure 1** (photograph of High Stacks in North East England) to answer the following questions:



Figure 1: Photo of High Stacks

a) Identify landforms X and Y

[2]

Landform X _____

Landform Y _____

b) Outline two pieces of evidence from the photo that the cliff line is composed of more than one rock type

[2]

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c) Describe a weathering process that may be acting on the upper part of the cliff line, above the high-water mark

[2]

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d) Explain the role of processes of erosion in the creation of landforms found in the photograph

[4]

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[Total: 10 marks]

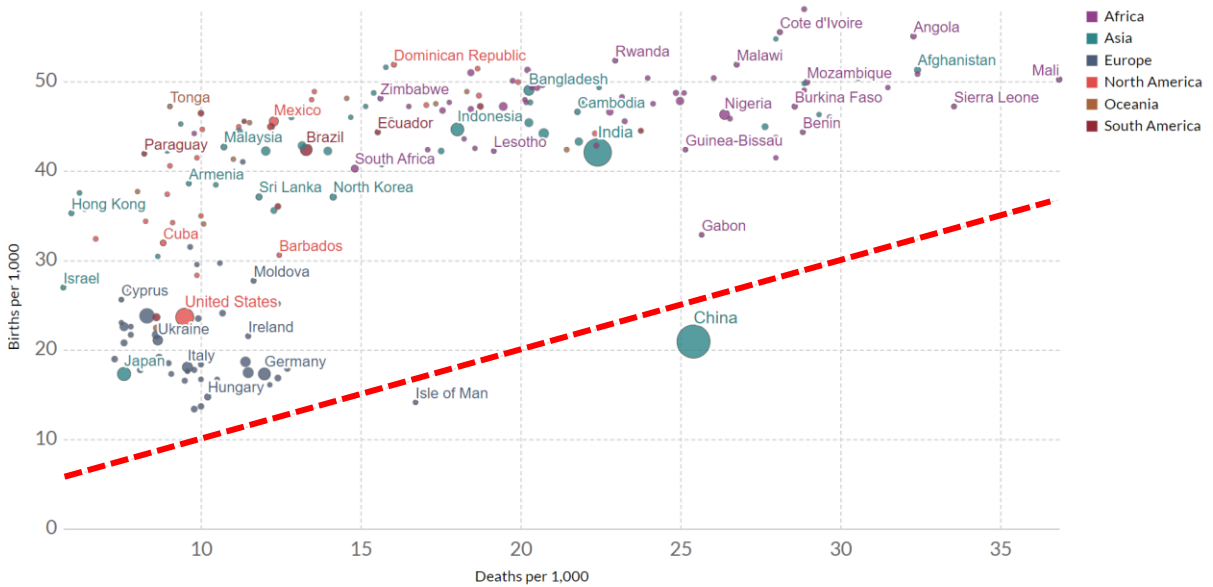
END OF QUESTION 1

QUESTION 2

Answer ALL of QUESTION 2

[spend 15 minutes on this section]

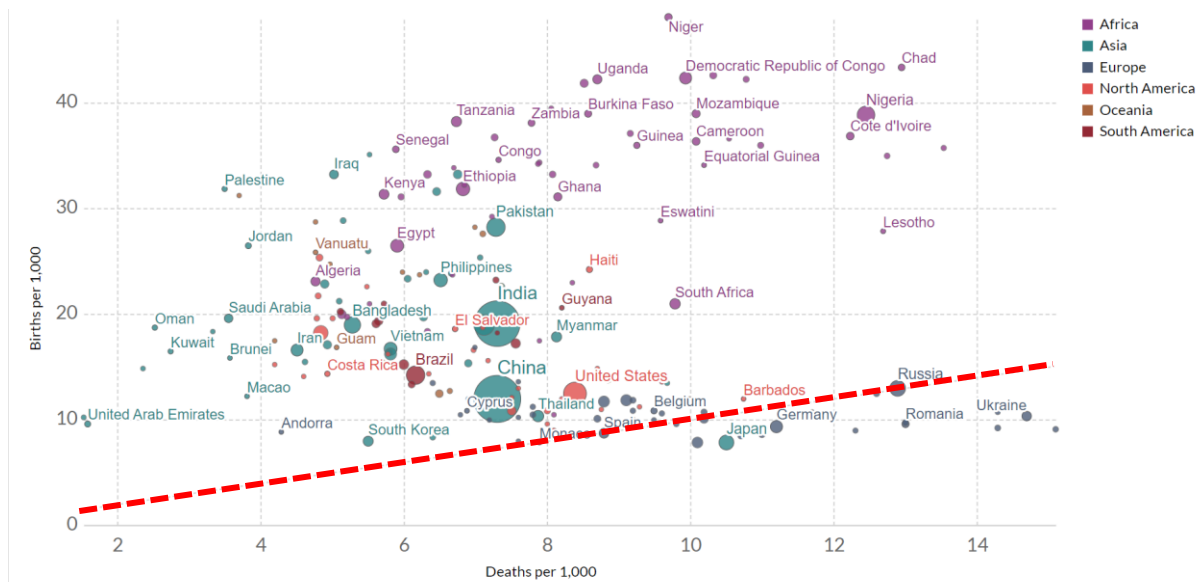
Use Figures 2 and 3 to answer the following questions



Source: World Bank, Population (Gapminder, HYDE(2016) & UN (2019)), Our World In Data

OurWorldInData.org/world-population-growth/ • CC BY

Figure 2: Scattergraph showing relationship between Birth Rate and Death Rate in 1960



Source: World Bank, Population (Gapminder, HYDE(2016) & UN (2019)), Our World In Data

OurWorldInData.org/world-population-growth/ • CC BY

Figure 3: Scattergraph showing relationship between Birth Rate and Death Rate in 2016

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Extra Space

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Total: [10 marks]

END OF QUESTION 2

QUESTION 3

[Spend 30 minutes on this section]

Answer any **one** of the following essay questions and in each case refer to specific examples, places and processes.

Credit will be given for the use of named and located examples, and the use of well-labelled sketch maps and diagrams, where appropriate.

EITHER

- a) To what extent is it ever possible to achieve true **sustainability** when managing **urban development**? [20]

OR

- b) To what extent do you agree that securing investment from **multinational companies** is the best way to encourage **development**? [20]

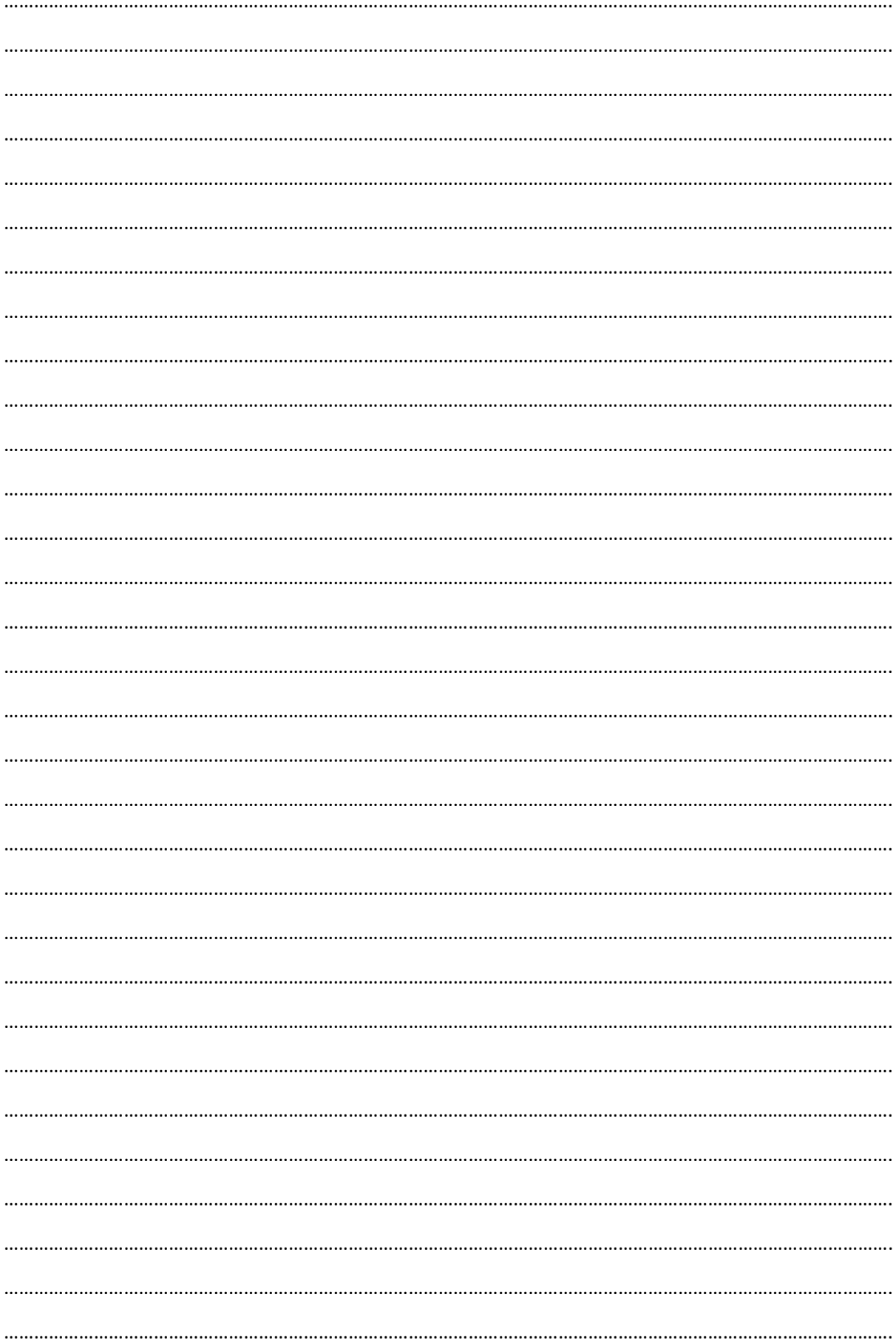
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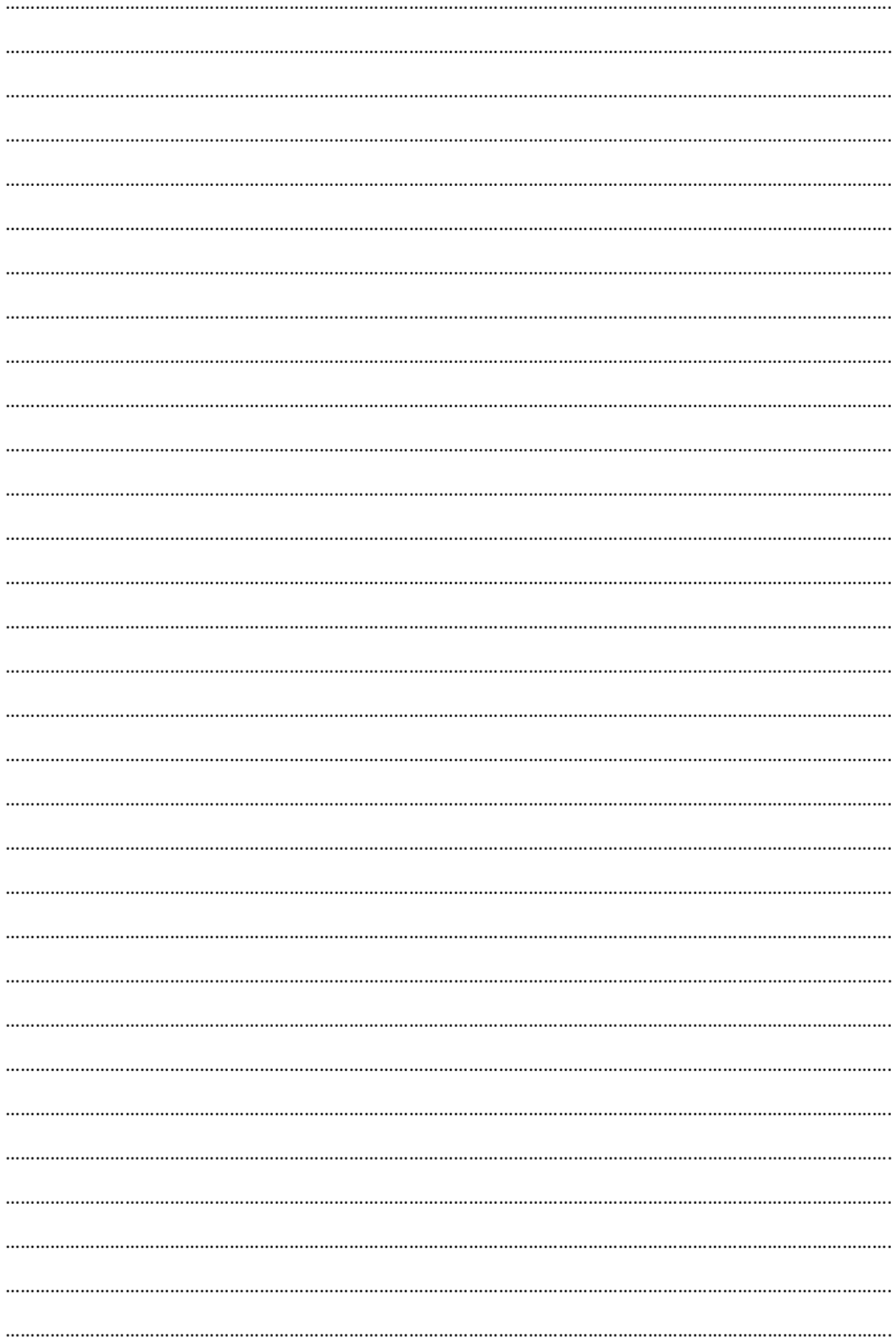
- c) To what extent do you agree that the major cause of **risk** in river valleys **or** coastal regions is due to **physical factors**? [20]

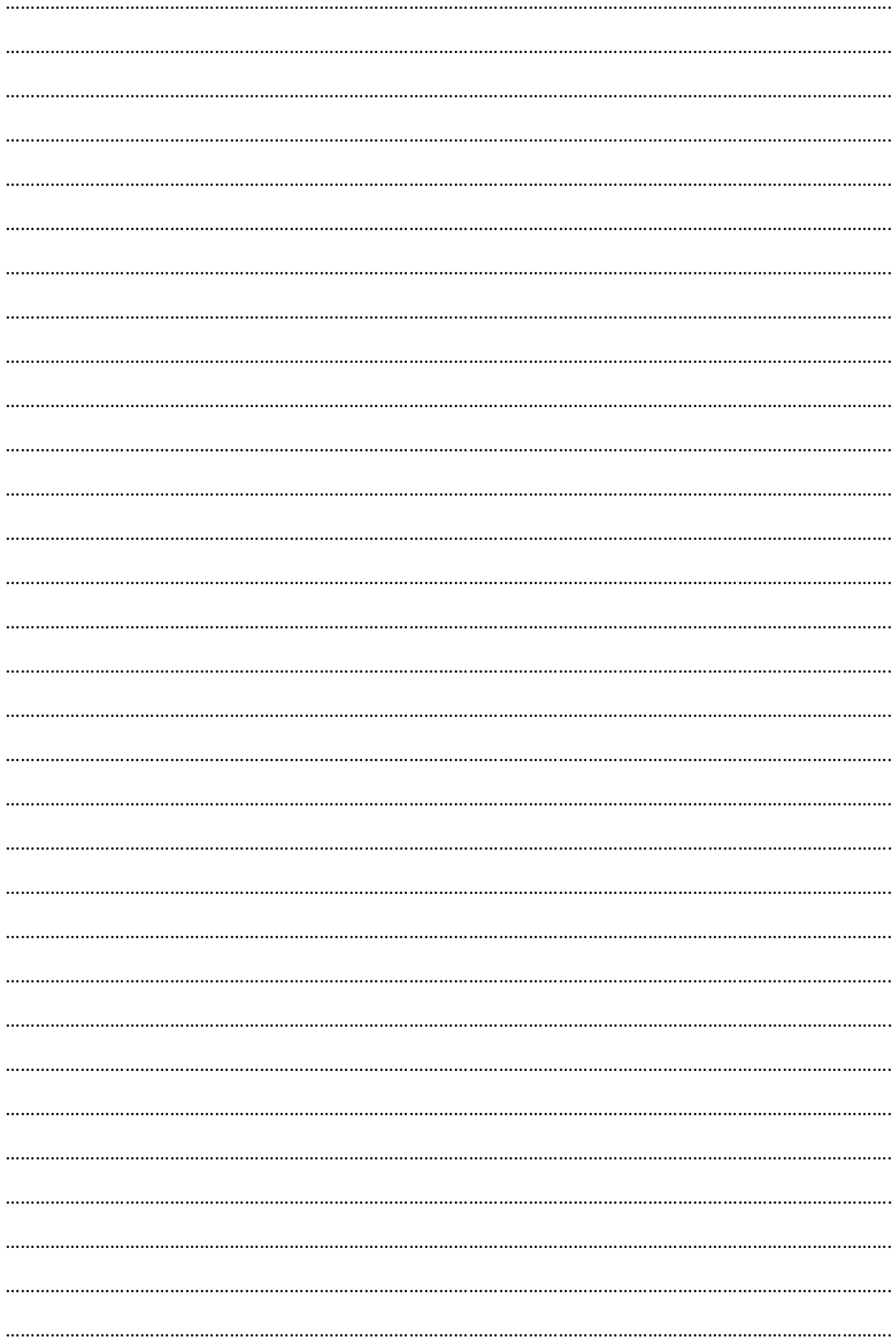
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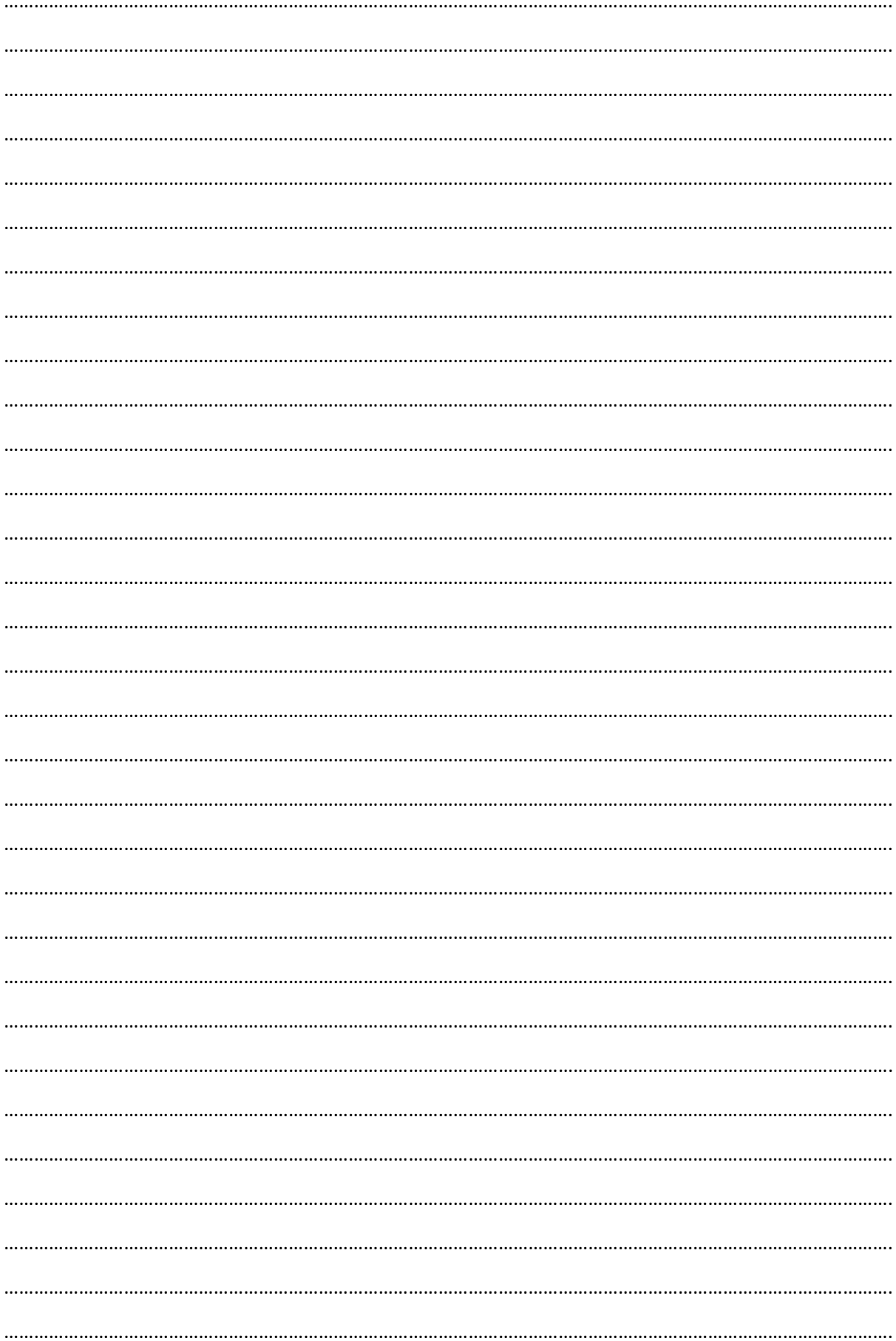
- d) To what extent do you agree that **climate** in the British Isles is influenced most greatly by **local factors**? [20]

Space to plan your answer:









A series of horizontal dotted lines for writing.

[Total: 20 marks]

[Exam Total: 40 marks]

END OF EXAMINATION



HARROW SCHOOL

ENTRANCE SCHOLARSHIPS EXAMINATION 2021

CLASSICAL GREEK **1 hour**

GENERAL INSTRUCTIONS:

You must attempt all questions.

You should make an intelligent guess at words you do not know, using your knowledge of English vocabulary.

Try to base any guesses on elements in the sentence that you definitely DO know and make sure that they make sense in context.

Use blue or black ink.

SECTION A: Reading and Grammar (50 marks)

1 Identify the following Greek proper names by transliterating the Greek.

- (a) Καλλιόπη
- (b) Ιάσοντας
- (c) Λεωνίδαας
- (d) Σελήνη
- (e) Ανεμώνη

[5]

2 Transliterate the following English into Greek (i.e. write them in Greek letters). Long vowels (eta, omega, etc.) are indicated with a macron (e.g. 'ē' or 'ō'). Remember to add breathings where appropriate.

- (a) Hekabē
- (b) Kalypsō
- (c) Cassandra
- (d) Medousa
- (e) Persephonē

[5]

3 Change the following nouns from plural to singular, keeping the same case. Write out the Greek singular form and give the basic meaning of each word.

Example: τους δουλους = τον δουλον (slave)

- (a) τας ειρηνας
- (b) των φοβων
- (c) οί κηρυκες
- (d) τα ονοματα
- (e) τοις φύλαξι

[10]

4 **Change the following nouns from singular to plural, keeping the same case. Write out the Greek plural form and give the meaning of each word.**

(a) τον ἡγεμονα

(b) ἡ γυνή

(c) τοῦ υἱοῦ

[6]

5 **Change the following verbs from single to plural, or plural to single, keeping the same person and tense. Then translate your answer.**

(a) παρειμι

(b) κρύψομεν

(c) ἤκουσα

(d) καθέυδετε

(e) εὔρον (plural)

[10]

6 **The following English words are derived from Greek words. What do they mean in English?**

Write down any Greek work you might know related to the English word.

(a) chronology

(b) basilica

(c) hegemony

(d) politics

(e) hydrology

(f) oligarchy

[6]

7 **Write out any TWO of the following:**

(a) The full future of πειθω.

(b) 2nd declension noun τό σωμα in all its cases (singular & plural).

(c) Decline the pronouns ἐγώ and σύ.

(d) The masculine definite article (singular & plural).

[8]

SECTION B: Sentences and Composition (35 marks)

1 Translate into English:

- (a) ἡ θυγατηρ ἐθελει βαινειν προς την ἀγοραν. [4]
- (b) ὁ κῆρυξ δυο ἡμερας ἐν τη πολει μενει, ἐπειτα ἀποβαινει εἰς το στρατοπεδον. [5]
- (c) τίνες εἰσὶν αἱ μετα τῶν φιλῶν; [3]
- (d) ὁ πατηρ αὐτος τον του φυλακος χρηματα ἔλαβεν. [4]
- (e) ἄρα ἐλευθερος τις ἐν τη νησῶ ἐστιν; [4]

2 Translate into Greek:

- (a) The stranger stops the evil war. [5]
- (b) The rich Athenians were honouring the goddess. [5]
- (c) Write and send letters to the city! [5]

SECTION C: Translation (30 marks)

Translate the passage into good English. Write your translation on alternate lines. Vocabulary is given at the foot of the page. Try to identify the proper names mentioned in the passage.

Socrates goes with his friend to the theatre in Athens

οἱ μὲν οὖν πρὸς τὴν ἀγορὰν πολεῶς βαίνουσιν, οἱ δὲ πρὸς δὲ τὸ θέατρον βαδίζουσιν. ἐκεῖ γὰρ ἐθέλουσι τὴν καινοτάτην τοῦ Ἀριστοφάνου κωμῶδιαν θεωρεῖν. ἡ κωμῶδια ὀνόματι Νεφέλαι ἐστίν. ὁ Σωκράτης καὶ οἱ αὐτοῦ φίλοι ἐτοῖμοι εἰσὶν καθίζειν ἐν τῷ θεατρῷ.

ὁ μὲν Σωκράτης ἐστὶν ὄλβιος, ὁ δὲ Ἀλκιβιάδης καὶ ὁ Ἀριστοφάνης μάλα φροντίζουσιν. ἡ γὰρ κωμῶδια τῷ Σωκράτῃ οὐκ ἐστὶ γέλοια. ἀλλὰ ὁ Ἀλκιβιάδης μάλιστα φροντίζει. ὁ γὰρ τῷ Σωκράτῃ οὐκ ἀληθῶς εἶπε περὶ τὴν κωμῶδιαν. ὁ δὲ Σωκράτης οὐ φροντίζει. ὁ γὰρ Σωκράτης τὴν κωμῶδιαν θεωρεῖν ἐθέλει. αἱ τοῦ Ἀριστοφάνου κωμῶδιαι αἰεὶ εἰσι γέλοια.

ἡ ύσάτη τοῦ Ἀριστοφάνου κωμῶδια μάλιστα ἦν γέλοια. ἡ ὀνόματι Ἀχαρνῆς ἐστίν. ἡ δὲ ἐκείνη κωμῶδια περὶ τὸν δύσκολον ἀνδρὰ ἦν. ἐν μὲν τῇ ἐκείνῃ κωμῶδιᾳ, ὁ δύσκολος τῷ πολέμῳ ὀργίζεται, ὁ οὖν ἀνθρωπος τὰς αὐτοῦ σπονδὰς ποιεῖ μετὰ τῶν Λακεδαιμονίων.

ἐπεὶ δὲ οἱ φίλοι εἰς τὸ θέατρον ἀφικνοῦνται, ὁ μὲν Ἀριστοφάνης φησὶν “ἦδου, ὦ Σώκρατα, τὴν γέλοϊαν κωμῶδιαν”

Vocabulary

βαδίζω	I walk
καινος, -η, -ον	new
κωμῶδια	comedy
θεωρεῶ	I watch
Νεφέλαι	“The Clouds”
ὄλβιος, -η, -ον	happy
γέλοιος, -η, -ον	funny
μάλα	a lot, much
φροντίζω	I worry
ἐστὶ	<i>future of</i> ἐστίν
ἀληθῶς	truthfully
περὶ	regarding
ύσάτος, -η, -ον	last, latest
ἐκείνος, -η, -ον	that
δύσκολος, -η, -ον	troublesome, unpleasant
ὀργίζεται	“He gets angry”
ἡ σπονδη	a treaty, an agreement
ποιεῖ	“he makes”
ἀφικνοῦνται	“they arrive”
ἦδου	“Enjoy!” (imperative)



HARROW SCHOOL

History Scholarship Examination 2021

Time: 90 Minutes

There are three sections in this examination.

You are advised to spend approximately 30 minutes on each section.

The quality of your answers is more important than the quantity, so spend 5-10 minutes thinking and 20-25 minutes writing for each section.

Each section is worth 30 marks in total.

SECTION A

Read the background information, and study both sources. Then answer both questions.

Background information

On 14 October 1962 an American U-2 reconnaissance plane obtained photographic evidence of missile sites on the Caribbean island of Cuba. These missile sites had been created by the Soviet Union (USSR); one of the great superpowers of the world from 1922 until its eventual collapse in 1991. The discovery of these missile sites eventually led to an event known as the Cuban Missile Crisis. The crisis was resolved at the end of October 1962 when Nikita Khrushchev (leader of the Soviet Union from 1953 until 1964) agreed to remove the missiles and John F. Kennedy (35th President of America from 1961 until 1963) agreed not to invade Cuba. Kennedy also agreed to remove American missiles from Turkey.

Did Khrushchev achieve what he wanted by placing missiles on Cuba? Any answer to this question needs to take into account his motives in putting the missiles there in the first place. Was he merely trying to protect Cuba from the USA, or was he planning to attack the USA? Was it an attempt to strengthen the Soviet Union's overall military position in relation to the West? Some have suggested the Soviet Union was trying to defend its position as world leader of Communism against its rival China.

By the end of the crisis it appeared to many people that Khrushchev had backed down and been humiliated. But was this really the case?

SOURCE A: Nikita Khrushchev speaking in December 1962 to the Supreme Soviet (the parliament of the USSR).

...We carried weapons there at the request of the Cuban government. Cuba needed weapons as a means of deterring the aggressors, and not as a means of attack. We sent about forty missiles to Cuba. Naturally, neither we nor our Cuban friends thought that this small number of missiles would be used for an attack on the United States. Our aim was only to defend Cuba.

SOURCE B: Fyodor Burlatsky, Nikita Khrushchev's assistant, writing in 1992, recalled how the Soviet leader decided to send missiles to Cuba during a visit to Bulgaria in May 1962.

Khrushchev was walking along a beach on the Black Sea with Defence Minister Malinovskiy, who pointed out to him that American military bases with nuclear warheads capable of wiping out the cities of Kiev, Minsk and Moscow in a matter of minutes were located on the opposite shore in Turkey. Khrushchev then asked Malinovskiy, 'And why then can we not have bases close to America? What's the reason for this imbalance?' And right then and there Khrushchev began to question Malinovskiy about whether or not it would be possible to deploy missiles secretly in Cuba. Malinovskiy assured him that the missiles could be deployed without detection.

Questions

Question 1

Study Source A. Explain in your own words why Nikita Khrushchev says that 'Naturally, neither we nor our Cuban friends thought that this small number of missiles would be used for an attack on the United States. Our aim was only to defend Cuba' in his speech of December 1962. [10 marks]

Question 2

Study Sources A and B. How and why do they differ in their explanations as to Nikita Khrushchev's motives in placing missiles on Cuba in 1962? [20 marks]

SECTION B

Answer ONE of these questions.

Either

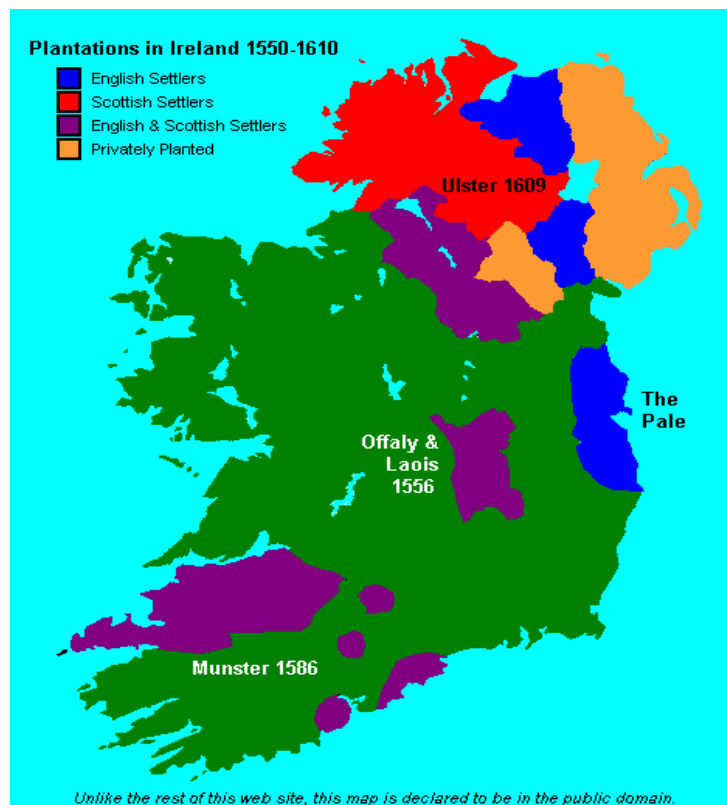
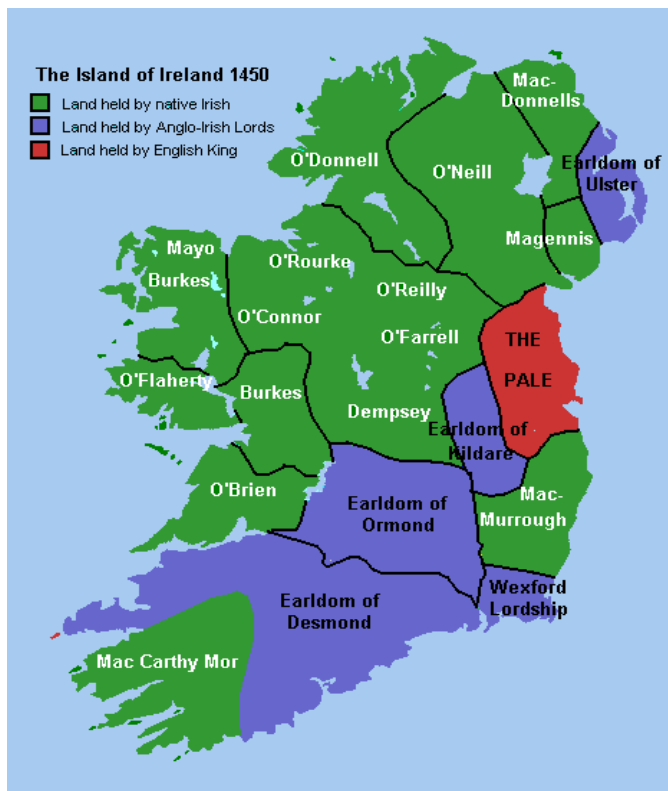
3. Napoleon Bonaparte stated that 'History is a set of lies agreed upon.' How far do you agree with this statement? Use what you have studied about at school to help you answer this question. [30 marks]

or

4. Martin Luther King Jr. stated that 'We are not makers of history. We are made by history.' How far do you agree with this statement? Use what you have studied about at school to help you answer this question. [30 marks]

SECTION C

5. Study the two maps. What can you tell from these maps about changes that occurred in Ireland between 1450 and 1610? [30 marks]





HARROW SCHOOL

ENTRANCE SCHOLARSHIPS EXAMINATION 2021

LATIN

1 hour

GENERAL INSTRUCTIONS:

You must attempt all questions.

You should make an intelligent guess at words you do not know, using your knowledge of English vocabulary and the English introduction to each passage.

Use blue or black ink.

[/65]

Section 1: Translation

Hannibal, the Carthaginian general, launches an attack on Italy, and thus begins the second Punic War with Rome.

Romani multos annos totam Italiam et partem Siciliae tenebant. hostes eorum in Sicilia Hispaniaque Carthaginenses erant. fuerat antea unum bellum inter eos in quo plurimi milites necati erant. post paucos annos pacis tamen novus dux Carthaginiensis, Hannibal nomine, Romanos iterum oppugnare constituit.

maximas igitur copias collegit — CL milia ut dicitur. Hannibal Romanis nihil respondit qui eum monebant ne socios oppugnaret. Romani tandem nuntium miserunt ut eum rogarent ne bellum contra se gereret. Hannibal respondit se populum Romanum non timere; et se mori malle quam patriam suam a Romanis victam videre. omnes igitur magnum bellum exspectabant.

mox Hannibal ad Italiam profectus est, non tamen per viam exspectatam (id est trans mare) sed modo inusitato. cum pars exercitus Romani in Hispaniam, pars ad Siciliam missa esset, Hannibal subito multis cum milibus peditum equitumque — non sine XXX elephantis — trans Alpes quam celerrime festinavit et in Italiam ingressus est.

Names

Hannibal, -alis (m)	Hannibal
Sicilia, -ae (f)	Sicily
Hispania, -ae (f)	Spain
Carthaginensis(m)	Carthaginian

Vocabulary

pax, pacis f.	peace
milia, from mille	1000
socius, -i m.	ally, friend
inusitatus, -a, um	unused
pedites, -um pl.	foot soldiers
equites, -um pl.	calvary

Translate the passage into good English.

Use alternate lines.

[30 marks]

Section 2: Comprehension

When the young girl Daphne could not escape Apollo, the god who had fallen in love with her, she prayed to her father to help her get away, with surprising results.

Apollo, dum Daphnen sequitur, 'mane!' inquit 'sic cerva leonem fugit. ego te sequor, quod te amo. eheu! terra, per quam curris, aspera est. curre igitur lentius, lentiusque sequar ego.' timebat ne puella caderet in terram.

rogavit num sciret quis eam amaret: 'non agricola sum' inquit 'sed filius lovis.' plura dicere voluit, sed puella iam aberat. Apollo iterum amore incensus quam celerrime cucurrit, paulatimque propius ad puellam adiit. quae cum iam fessa ambulare coepisset, aquas fluminis conspexit: statim patrem rogavit ut iuvaret. 'muta figuram meam' clamavit. his verbis dictis, arbor facta est.

Names

Daphne, Daphnes (f) (accusative Daphnen)	Daphne
Iupiter, Iovis (m)	Jupiter

Vocabulary

cerva, cervae (f)	deer
asper, aspera, asperum	rough
paulatim	gradually
incensus	burning, set on fire
muto, mutare, mutavi, mutatus	I change
figura, figurae (f)	shape
arbor, arboris (f)	tree

Answer the following questions. Make sure to number your answers correctly.

1. In line 1, what simile does Apollo use to liken his pursuit of Daphne? [2]
2. ego...amo (lines 1-2): what argument does Apollo use to try to persuade Daphne to stop? [2]
3. eheu! (line 2):
 - a. What fear prompts Apollo to say this? [1]
 - b. What compromise does he suggest to Daphne because of this fear? [3]
4. Lines 4-5:
 - a. how does Apollo try to convince Daphne that he is worthy of her? [2]
 - b. how much notice did Daphne take of what he said? [2]
5. *Apollo ... coepisset* (lines 5-6): explain fully why Apollo began to catch up with Daphne. [5]
6. In lines 6-8, how successful was Daphne in escaping from Apollo's attentions? [3]

[20 marks]

Section 3: Grammar

Leander swims across the river Hellespont at night to meet his girlfriend Hero but this love affair ends in tragedy.

1 Leander iuvenis pulcher erat qui in altero Hellesponti habitabat. puellam conspectam amavit. puella Hero nomine, in altero litore habitabat. Leander igitur trans Hellespontum nocte natabat.

5 Hero lucernam in litore relinquebat ut viam ei ostenderet. prima luce Leander domum natabat. hoc per totam aestatem laetissime faciebant. ubi hiems advenit, tempestates saepe erant. Leander tamen trans Hellespontum natabat; amor puellae tantus erat ut periculum non timeret.

olim tamen lucerna vento extincta est. itaque Leander e via erravit et in undis periit. ubi dies advenit Hero, corpore non viso, a summo templo se in mare iecit.

Names

Leander -dri (m)

Leander

Hellespontus -i (m)

Hellespont (Dardanelles, channel separating Europe from Asia)

Hero (f)

Hero

Vocabulary

litus -oris (n)

shore

nato -are

I swim

lucerna -ae (f)

lamp

aestas -atis (f)

summer

hiems hiemis (f)

winter

extinguo -ere extinxi extinctus

I extinguish

1. Find an adjective in line 1.
2. What case is *nomine* in line 2?
3. What tense is *habitabat* in line 2?
4. What case is *nocte* in line 3, and why is it in this case?
5. Why is *ostenderet* in the subjunctive in line 4?
6. What case is *totam aestatem* in line 5, and why is it in this case?
7. Why is *timeret* in line 7 in the subjunctive?
8. What case is *vento* in line 8?
9. What tense is *erravit* in line 8?
10. Identify a verb in the passive voice.
11. Identify a reflexive pronoun.
12. Identify a pronoun in the dative case.
13. Identify a preposition in line 5.

[15 marks]



HARROW SCHOOL

Mathematics I **2021 Scholarship Paper**

1 ½ Hours

Calculators and geometrical instruments are permitted

Instructions: • Answer in the spaces in the question paper. • Show your working clearly.

Question 1 (4 marks)

Find the next two numbers in the following sequences:

a) $-22, -25, -29, -34, \dots$

_____ [2]

b) $5, 8, -3, 11, \dots$

_____ [2]

Question 2 (11 marks)

Solve:

a) $\frac{4}{x-1} + 3 = 7$

_____ [3]

$$\text{b) } \frac{x}{5} + \frac{2x-1}{3} = 4$$

_____ [3]

$$\text{c) } \frac{1}{4}(y-1)^2 = 25$$

_____ [3]

d) Find the smallest whole number that satisfies $4 - 3x < 19$

_____ [2]

Question 3 (3 marks)

Find 4 numbers with mean 6.5, mode 9 and median 7

_____ [3]

Question 4 (4 marks)

x and y represent numbers. We know that $x \div y = 2.5$

Write down the value of:

a) $2x \div y$

_____ [1]

b) $x \div 10y$

_____ [1]

c) $\frac{y}{x}$

_____ [2]

Question 5 (4 marks)

Simplify fully:

a) $\frac{a}{2} + \frac{2a}{5}$

_____ [2]

b) $\frac{p}{q} \div \frac{3p}{q^2}$

_____ [2]

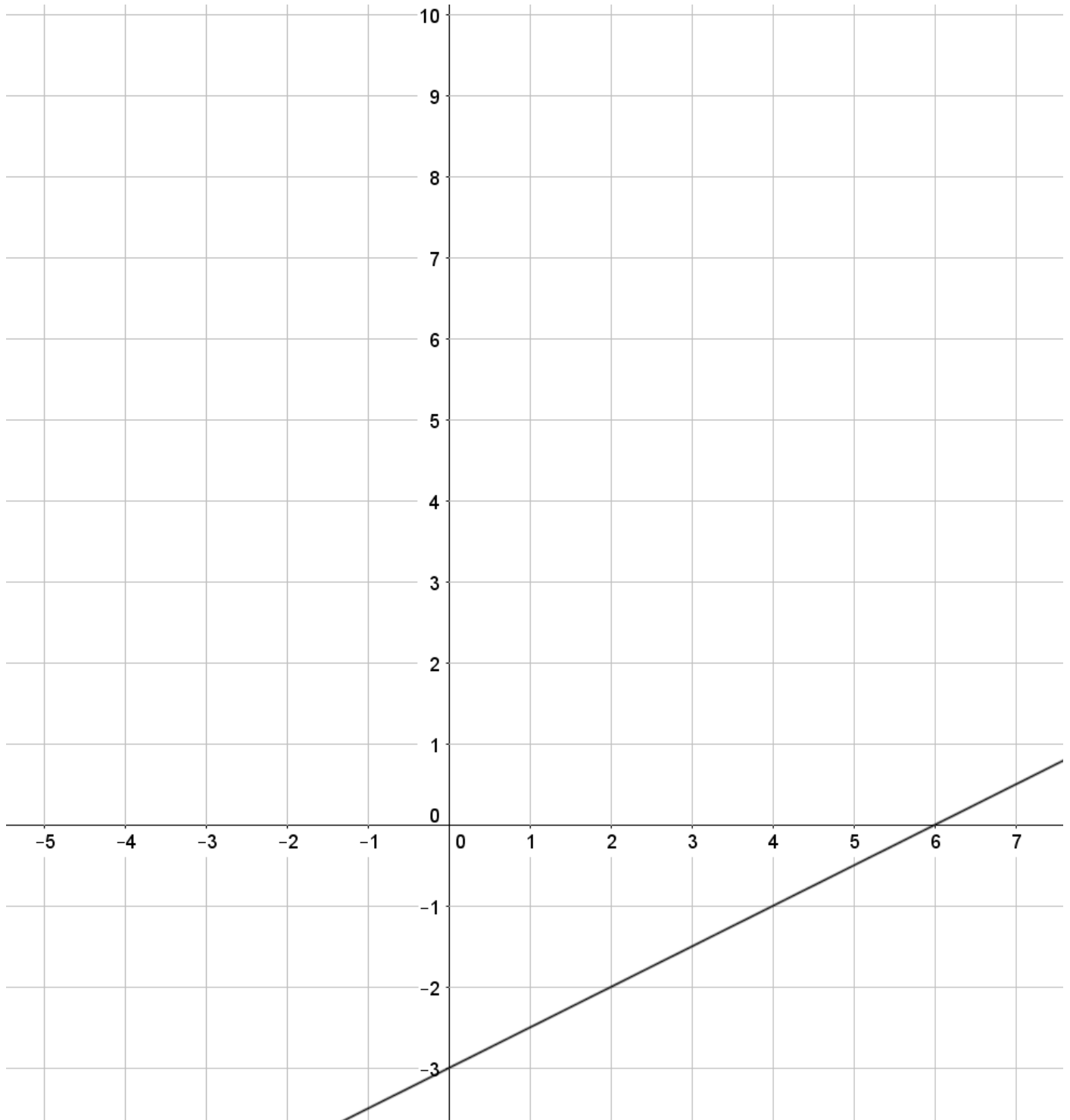
Question 6 (4 marks)

I invest £8000 into a bank account. At the end of the year interest is added. I have to pay 40% tax on the interest. I pay £144 tax. What is the interest rate on the account?

_____ [4]

Question 7 (6 marks)

a) On the axes below draw $y = 3x + 1$ and $3y + 2x = 12$



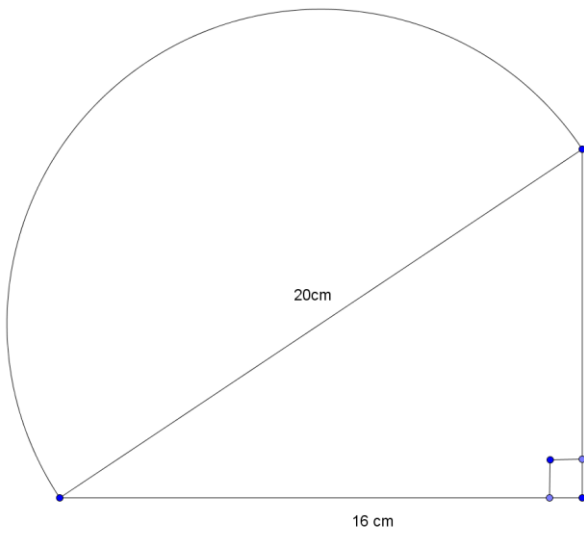
[4]

b) Write down the equation of the line on the graph

_____ [2]

Question 8 (5 marks)

Calculate the area of this shape. Give your answer to one decimal place.



_____ [5]

Question 9 (4 marks)

a) Calculate the lowest common multiple of 8, 9 and 10.

_____ [2]

b) Calculate the highest common factor of $10x^2y^5$ and $15x^3y^2$.

_____ [2]

Question 10 (4 marks)

Solve

$$y = 3x + 7$$
$$5y - 2x = 22$$

_____ [4]

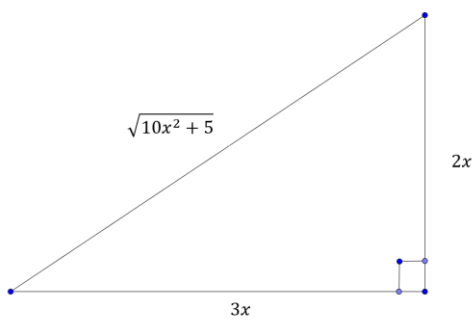
Question 11 (4 marks)

The area of a semi-circle is 100cm^2 . Calculate the perimeter of the semi-circle to one decimal place.

_____ [4]

Question 12 (4 marks)

Calculate the value of x to one decimal place.



_____ [4]

Question 13 (3 marks)

The ratio of my age to my brother's age is 5:3. My sister is three quarters as old as my brother. What is the ratio of my age to my sister's age? Give your answer as a ratio in its simplest form.

_____ [3]



HARROW SCHOOL

Scholarship Examination 2021

Mathematics II

Time: **90 Minutes**

Instructions and advice:

Write your solutions on lined paper, using blue or black ink or pencil. Calculators, geometric instruments (protractor, set square, compass etc.) and squared paper may NOT be used.

Write on only one side of the paper and start your answer to each question on a fresh sheet. Make sure the question number and your name are clearly written on each sheet.

This paper is designed to be very challenging.

Very few (if any) candidates should expect to finish it.

Greater credit will be given for a smaller number of complete solutions to some of the questions rather than a larger number of incomplete attempts.

You do not need to attempt the questions in the order in which they are presented (indeed, you are advised to first read all the questions then start by attempting those with which you feel the most comfortable).

You must show all your working and explain all your reasoning.

PLEASE NOTE: This paper is not just about getting the right answers; correct answers on their own will earn few marks. You will be marked more on the PRESENTATION of your solutions, the EXPLANATION of your working and the JUSTIFICATION of your final answers.

1. Calculate the following, showing any intermediate steps or methods you use:

- a. 375×48
- b. $477777773 \div 43$
- c. $\frac{1}{0.01^3}$
- d. $3\frac{13}{33} \div 12\frac{8}{11}$
- e. 35% of 85% of $\frac{5000}{119}$
- f. $\sqrt{3\frac{1}{16}}$
- g. $\frac{1}{\frac{1}{7} \frac{1}{9}}$

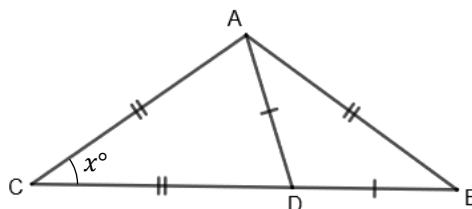
2. There is a story about the German mathematician Carl Gauss in which, when he was eight years old, his school teacher asked the class to work out $1 + 2 + \dots + 99 + 100$. He stunned his teacher by writing down the right answer only a few seconds after the teacher had finished asking the question. He achieved this feat by recognising that the question is greatly simplified by pairing up the numbers in a particular way – the first with the last, the second with the last-but-one and so on.

- a. When paired up in this way, what is the sum of each pair?
- b. How many such pairs are there?
- c. Using your answers to parts (a) and (b), deduce Gauss' answer.
- d. Find the following sums:
 - i. $1 + 2 + \dots + 9999 + 10\,000$
 - ii. $1 + 2 + 3 + \dots + (n - 1) + n$ (where n is an integer)
 - iii. $2 + 6 + 10 + 14 + \dots + 250$
 - iv. $101 + 102 + 103 + \dots + 300$
 - v. $1 + 2 + 4 + 5 + 7 + 8 + \dots + 995 + 997 + 998 + 1000$ (this sum is missing all the multiples of 3)

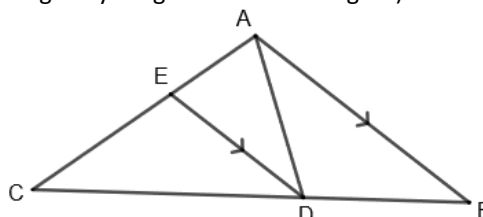
3. Estimate, to one significant figure, the number of times your heart will beat in your lifetime. You will need to state any assumptions you make.

4. Jonah has drawn a geometric diagram.

- a. In his diagram (below), CDB is a straight line and the marked sides are equal. What is the size of the angle x ? Ensure you explain each step of your reasoning.



- b. Jonah then draws an extra line in his diagram which passes through D and is parallel to AB , as shown in the diagram below (he doesn't change anything else about the figure).



Determine, justifying your answer, the value of the ratio
 Area of ABD : Area of CDE

5. Maths-itis is a very rare disease, which affects one person in every 10 000. Professor Stewart has come up with a test for Maths-itis which is 99% effective (i.e. if it says you have Maths-itis it is right 99% of the time and if it says you don't it is right 99% of the time).

You use Professor Stewart's test to test a million people for Maths-itis.

- How many of the million people would you expect to have Maths-itis?
- Of these people, how many of them will be told they have it when they are tested?
- Of the people who *don't* have Maths-itis, how many will be told they *do* have it when they are tested?
- Of the people who were told they did have Maths-itis when they were tested, how many actually have it?
- Would you say Professor Stewart's test is a good one?

6. A number is divisible by 9 if and only if the sum of its digits is divisible by 9. For example:

94 815 is divisible by 9, since its digit sum is 27 ($= 3 \times 9$), but
1575 is not, since its digit sum is 17 which is not divisible by 9.

A number is divisible by 11 if and only if the difference between the sums of its alternate digits is divisible by 11. For example:

$\underline{1} \overline{7} \underline{2} \overline{9} \underline{3} \overline{2} \overline{0} \underline{7} \underline{2} \overline{5}$ is divisible by 11, because $\underline{1} + \underline{2} + \underline{3} + \underline{0} + \underline{2} = 8$, $\overline{7} + \overline{9} + \overline{2} + \overline{7} + \overline{5} = 30$, and the difference between 8 and 30 is 22, which is a multiple of 11;

406 802 is divisible by 11, since the difference between $(4 + 6 + 0)$ and $(0 + 8 + 2)$ is 0, which is a multiple of 11; but
836 910 is not, because the difference between $(8 + 6 + 1)$ and $(3 + 9 + 0)$ is 3, which is not a multiple of 11.

- Show that:
 - 9 876 543 210 is divisible by 9
 - 40 506 070 is divisible by 11 but not by 9
 - 12 345 654 321 is divisible by 99.
- The number $2d7\ 852$ (where d is an unknown digit) is divisible by 11. Find the missing digit d .
- The number $48\ 12e\ 453$ is divisible by 9. Explain why there are two possible values for the missing digit e and state what they are.
- The number $17a\ 35b$ is divisible by both 9 and 11. Find the missing digits a and b .

7. You are running through the train station to catch a train when you notice your bag is broken. In order to fix it, you will need to stop running for ten seconds. Ahead of you is an escalator (which takes more than ten seconds to travel up).

You have two options:

- You could stop running now, fix your bag then run to the train (running up the escalator), or
- You could run to the escalator, then once on it fix your bag before running the rest of the way to the train (including the running up the remainder of the escalator).

Which of these would you choose to minimise the time it takes you to get to your train? Justify your answer.

(You may assume that you run at a constant speed and that the escalator travels at a constant speed.)

8. In this question, n represents a positive integer. Find all possible values of n for which the following are true:

- $\frac{12}{n}$ is an integer
- $\frac{20}{n+1}$ is an integer
- $\frac{30}{2n-3}$ is an integer
- $\frac{2n}{n-6}$ is an integer (Hint for (d): $2n = 2n - 12 + 12$)

There are no questions printed on this page.



HARROW SCHOOL

Philosophy and Applied Ethics Scholarship Examination 2021

75 minutes

You have 30 minutes to read through the five sources and then 45 minutes to answer the question. Do take time to plan and draft your answer.

Use blue or black ink for text.

Source A

Aristotle (384-322 BCE), *Nicomachean Ethics* I 110a

Actions are commonly regarded as involuntary [done without conscious thought] when they are performed (a) under compulsion [force/pressure], (b) as the result of ignorance [lack of awareness]. An act, it is thought, is done under compulsion when it originates in some external cause of such a nature that the person subject to the compulsion contributes nothing to it. Such a situation is created, for example, when a sea captain is carried out of his course by a contrary wind or by men who have got him in their power. But the case is not always so clear... An involuntary act being one performed under compulsion or as the result of ignorance. A voluntary act [done with conscious thought] would seem to be one of which the origin lies in the person, knowing the particular circumstances in which he is acting.

Source B

Benedict Spinoza (1632-1677), *Ethics*, 1674, III ii note

An infant thinks it freely seeks milk, an angry child thinks that it freely desired vengeance, or a timid child thinks it freely chooses flight. Again, a drunken man thinks that he speaks by the free decision of the mind those things which, if he were sober, he would keep to himself... So experience teaches as clearly as reason that men think themselves free on account of this alone, that they are conscious of their actions and ignorant of the causes of them.

Source C

Pierre Laplace (1749-1827), *From Philosophy in Practice* (Morton, 1996), page 396

An intelligence knowing all the forces acting in the nature at a given instant... would be able to comprehend in one single formula the motions of the largest bodies as well as the lightest atoms in the world, provided that its intellect were sufficiently powerful to subject all data to analysis; to it nothing would be uncertain, the future as well as the past would be present to its eyes.

Source D

A. J. Ayer (1910-1989), *Philosophical Essays*, 1959

From page 275

Either it is an accident that I choose to act as I do or it is not. If it is an accident, then it is merely a matter of chance that I did not choose otherwise; and if it is merely a matter of chance that I did not choose otherwise, it is surely irrational to hold me morally responsible for choosing as I did. But if it is not an accident that I choose to do one thing rather than another, then presumably there is some causal explanation of my choice: and in that case we are led back to determinism.

Source E

Stephen Hawking (1942-2018), *Does God play dice?*, 1999

The loss of particles and information down black holes meant that the particles that came out were random. One could calculate probabilities, but one could not make any definite predictions. Thus, the future of the universe is not completely determined by the laws of science and its present state, as Laplace thought. God still has a few tricks up his sleeve.

Question:

'Humans don't have free will'.

Evaluate this view.

In your answer you should:

- give reasoned arguments to support this statement
- give reasoned arguments to support a different point of view
- reach a justified conclusion.

Determinism is the theory that all events, including moral choices, are completely determined by previously existing causes. This means that humans have no free will.

Free will is the ability to choose between different possible courses of action, including making moral choices.

To help, you might like to think about the following key questions:

1. Do humans have free will or are their actions already determined?
2. If human actions are determined, how are they determined?
3. Suggest evidence for and against humans having or not having free will.
4. Does not having free will mean that humans shouldn't be punished.

We would encourage you to use the sources and to give examples to help your arguments.



HARROW SCHOOL

Science Scholarship Examination 2021

90 Minutes

*Section 1 consists of 30 multiple choice questions.
You must select the best answer, A-D, for each question and mark your answers on the
separate Multiple Choice Answer grid provided.*

Sections 2, 3 and 4 are to be answered on the examination paper in the spaces provided.

Use blue or black ink for text.

You may use a pencil for diagrams.

You may use a calculator

**HARROW SCHOOL 13+ SCHOLARSHIP
SCIENCE EXAMINATION 2021
SECTION A: MULTIPLE CHOICE ANSWER SHEET**

For each of the multiple choice questions 1 – 30 in Section A, fill in the circle A, B, C or D on the grid below which you feel is the best answer. **USE AN HB PENCIL**

ENTER YOUR NAME IN THE BOX BELOW

Name

ZIPGRADE.COM

- | | | | | | | | | | |
|----|-----|-----|-----|-----|----|-----|-----|-----|-----|
| 1 | (A) | (B) | (C) | (D) | 17 | (A) | (B) | (C) | (D) |
| 2 | (A) | (B) | (C) | (D) | 18 | (A) | (B) | (C) | (D) |
| 3 | (A) | (B) | (C) | (D) | 19 | (A) | (B) | (C) | (D) |
| 4 | (A) | (B) | (C) | (D) | 20 | (A) | (B) | (C) | (D) |
| 5 | (A) | (B) | (C) | (D) | 21 | (A) | (B) | (C) | (D) |
| 6 | (A) | (B) | (C) | (D) | 22 | (A) | (B) | (C) | (D) |
| 7 | (A) | (B) | (C) | (D) | 23 | (A) | (B) | (C) | (D) |
| 8 | (A) | (B) | (C) | (D) | 24 | (A) | (B) | (C) | (D) |
| 9 | (A) | (B) | (C) | (D) | 25 | (A) | (B) | (C) | (D) |
| 10 | (A) | (B) | (C) | (D) | 26 | (A) | (B) | (C) | (D) |
| 11 | (A) | (B) | (C) | (D) | 27 | (A) | (B) | (C) | (D) |
| 12 | (A) | (B) | (C) | (D) | 28 | (A) | (B) | (C) | (D) |
| 13 | (A) | (B) | (C) | (D) | 29 | (A) | (B) | (C) | (D) |
| 14 | (A) | (B) | (C) | (D) | 30 | (A) | (B) | (C) | (D) |
| 15 | (A) | (B) | (C) | (D) | | | | | |
| 16 | (A) | (B) | (C) | (D) | | | | | |

Key

(A) (B) (C) (D)

13+ Scholarship Science Paper SECTION A 2020 (3515)

SECTION A: Science Multiple Choice Questions

For each of the questions in this section, identify which one of the answers A, B, C or D is correct and then indicate your answer on the separate *Multiple Choice Answer Sheet*.

1. Which foods are all rich in protein?
- A cabbage, cheese, egg, beef
 - B tuna, chicken, apple, peanut
 - C butter, spinach, bacon, banana
 - D lentil, lamb, turkey, milk
2. The following diagram shows the concentrations in parts per million (ppm) of the insecticide DDT in the tissues of different organisms in a food chain. How many times greater is the concentration of DDT in the osprey than in the plankton?
- plankton → minnow → trout → osprey
0.04 ppm 0.5 ppm 2 ppm 25 ppm
- A 625
 - B 25
 - C 250
 - D 62 500
3. What is the maximum magnification that can be achieved using a standard light microscope when the magnification of the eyepiece lens is x10 and the magnification of the high-power objective lens is x40?
- A x40
 - B x50
 - C x400
 - D x410

4. Approximately how many times does a human heart beat over the course of a normal life span?
- A 3 000 000
 - B 30 000 000
 - C 300 000 000
 - D 3 000 000 000
5. Which of the following animals are all vertebrates?
- A frog, shark, mouse, snake
 - B octopus, horse, eagle, eel
 - C turtle, earthworm, hummingbird, whale
 - D jellyfish, mole, kangaroo, monkey
6. What is the correct order of cells from the smallest to the largest?
- A bacterium, red blood cell, white blood cell, egg cell
 - B egg cell, bacterium, red blood cell, white blood cell
 - C white blood cell, red blood cell, egg cell, bacterium
 - D red blood cell, bacterium, sperm cell, egg cell
7. Approximately how fast can the fastest human run?
- A 9.6 km/h
 - B 23 km/h
 - C 38 km/h
 - D 100 km/h

8. If a bacterium divides into two new bacteria every 20 minutes, how many bacteria would there be after 12 hours?
- A 24
 - B 72
 - C 4096
 - D 7×10^{10}

9. Which of the following are all plant organs?

- A xylem, stomata, stem, leaf
- B stem, starch, fruit, root
- C waxy cuticle, starch, stomata, flower
- D flower, stem, root, leaf

10. Which structures are all bones in the human skeleton?

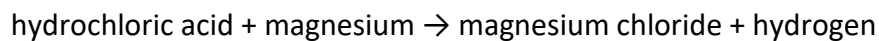
- A appendix, skull, collarbone, vertebral column
- B spinal cord, rib cage, pelvis, shoulder blade
- C biceps, pelvis, rib cage, collarbone
- D skull, rib cage, pelvis, shoulder blade

11. What type of reaction best describes the following equation?



- A Thermal decomposition
- B Oxidation
- C Displacement
- D Rusting

12. The word equation is shown for a reaction in which the total mass of the reactants is 26 g. What is the total mass of the products?



- A 13 g
- B 5 g
- C 52 g
- D 26 g

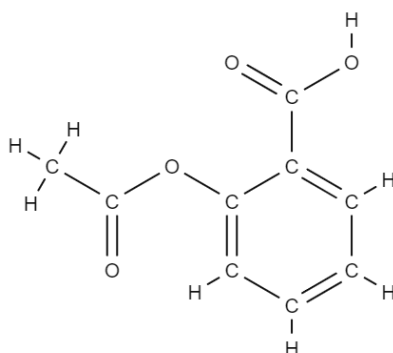
13. A test was done to see if the oxides of unknown elements P, Q, R and S would react with acid or alkali. A tick indicates there was a reaction

Oxide of Element	Reaction with acid	Reaction with alkali
P	✓	
Q		✓
R		✓
S	✓	

Which row identifies the elements as metals or non-metals?

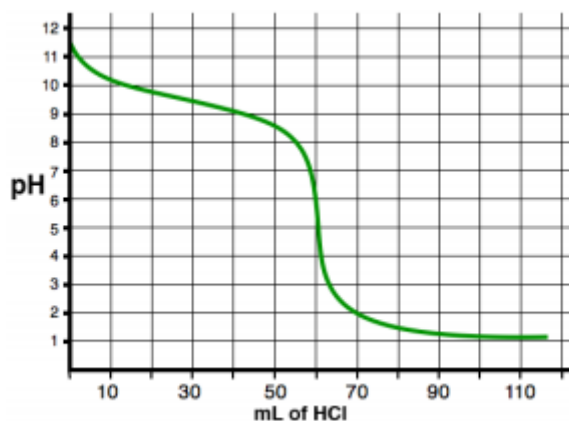
Element				
	P	Q	R	S
A	metal	non-metal	non-metal	metal
B	non-metal	metal	non-metal	metal
C	metal	non-metal	metal	non-metal
D	non-metal	metal	metal	non-metal

14. What is the chemical formula for the following compound?



- A $C_8H_8O_4$
 B $C_9H_8O_3$
 C $C_8H_9O_3$
 D $C_9H_8O_4$

15. A student monitored the pH of a solution of sodium hydroxide, NaOH, while they added hydrochloric acid, HCl. The results are displayed in the graph below.



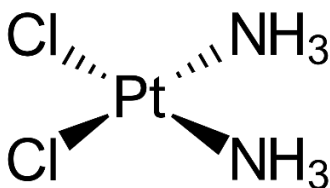
How many mL of hydrochloric acid was needed to completely neutralise the sodium hydroxide?

- A 10 mL
B 40 mL
C 60 mL
D 70 mL
16. The table records the mass of one atom of some elements. What is the mass of a hydrocarbon with 4 carbon atoms and 10 hydrogen atoms?

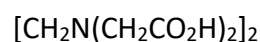
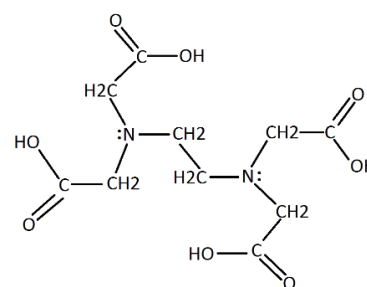
Element	Mass
Hydrogen	1
Lithium	7
Carbon	12
Sulfur	32

- A 13
B 48
C 10
D 58
17. The mass of a bromine nucleus is 80 u . Given that the mass of one proton is 1 u , and that bromine has 35 protons, what proportion of the mass of a bromine nucleus is protons?
- A 35 %
B 80 %
C 44 %
D 1 %

18. This diagram shows the 3D shape of “cis-platin”, a molecule used to treat cancer. Which name do you think best describes the shape?

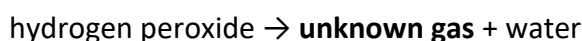


- A Octahedral
 B Linear
 C Square planar
 D Trigonal planar
19. Dentists use EDTA (short for “Ethylenediaminetetraacetic acid”) to loosen root canals. Surgeons use it to treat metal poisoning or complications of blood transfusions. Identify the correct number of elements and atoms in a molecule of EDTA.



	Number of elements	Number of atoms
A	3	28
B	4	34
C	3	22
D	4	36

20. The following reaction was carried out.



The unknown gas was tested, and the following observations were made

Bubbled through limewater	Tested with glowing splint
No observable change	Glowing splint extinguishes

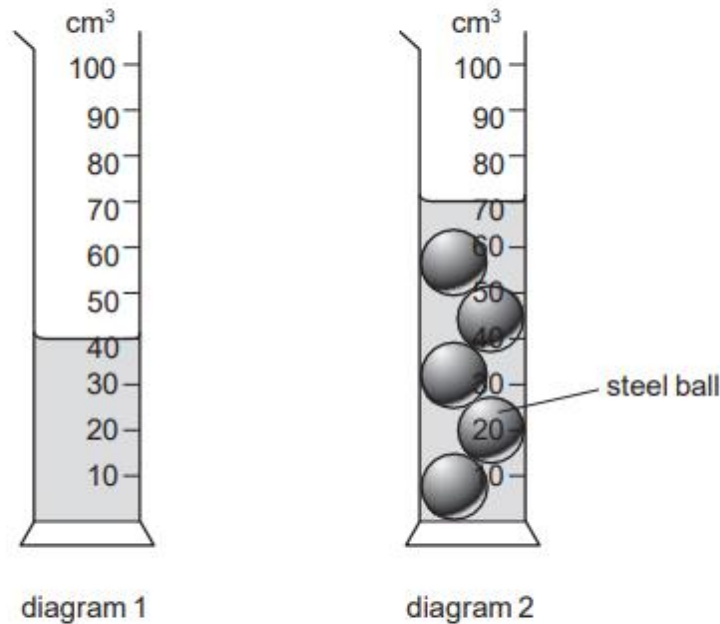
What is the identity of the unknown gas?

- A Argon
 B Oxygen
 C Carbon dioxide
 D Water vapour

21.

Diagram 1 shows a measuring cylinder containing water.

Five identical steel balls are now lowered into the measuring cylinder. Diagram 2 shows the new water level in the cylinder.



What is the volume of each steel ball?

- A 6 cm^3 B 14 cm^3 C 30 cm^3 D 70 cm^3

22.

A car travels 100 km. The journey takes two hours. The highest speed of the car is 80 km / h, and the lowest speed is 40 km/h.

What is the average speed for the journey?

- A 40 km/h B 50 km/h C 60 km/h D 120 km/h

23.

Which energy resource is used to generate electricity without using any moving parts?

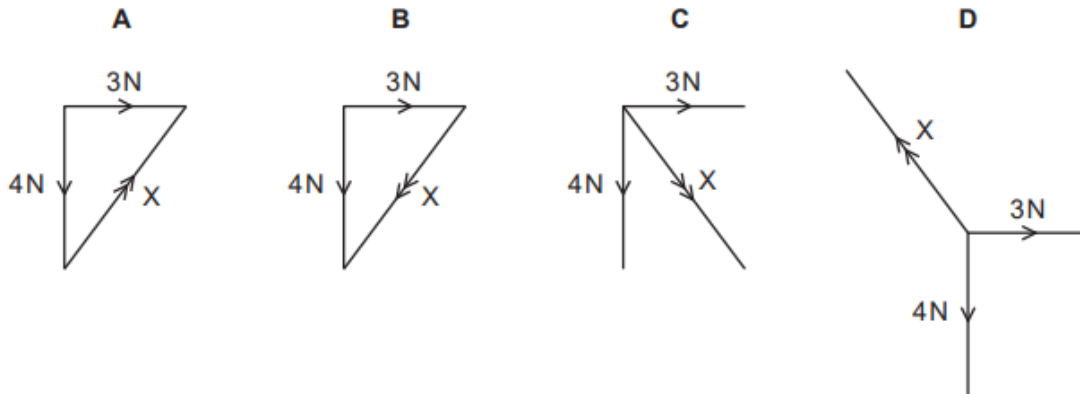
- A geothermal
- B hydroelectric
- C nuclear
- D solar

24.

An object is acted upon by a 3 N force and by a 4 N force.

Each diagram shows the two forces.

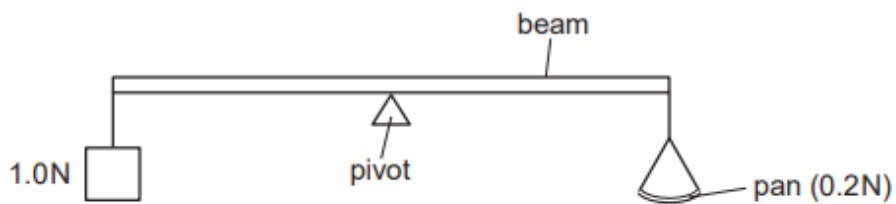
Which diagram also shows the resultant X of these two forces?



25.

The diagram shows a uniform beam being used as a balance. The beam is pivoted at its centre.

A 1.0 N weight is attached to one end of the beam. An empty pan weighing 0.2 N is attached to the other end of the beam.



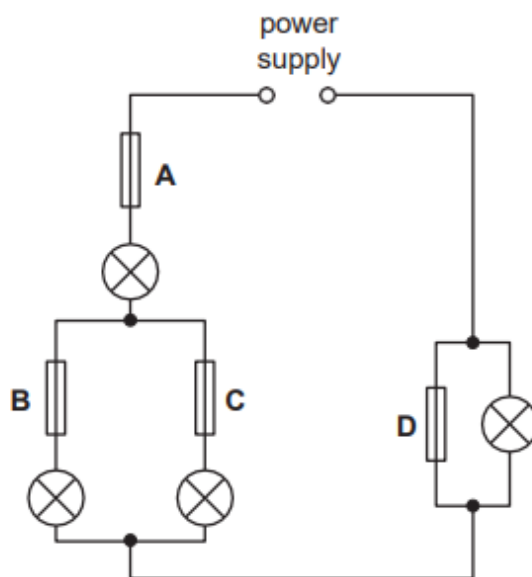
How many 0.1 N weights must be placed on the pan in order to balance the beam?

- A 5 B 8 C 10 D 12

26.

In the circuit shown, only one of the fuses has blown, but none of the lamps is lit.

Which fuse has blown?



27.

The current in a kettle is 10A and it is protected by a 13A fuse.

The owner of the kettle replaces the 13A fuse with a 3A fuse.

What happens when the kettle is switched on?

- A. The fuse blows and the kettle is damaged.
- B. The fuse blows and the kettle is undamaged.
- C. The fuse does not blow and the kettle works correctly.
- D. The fuse does not blow but the kettle fails to work.

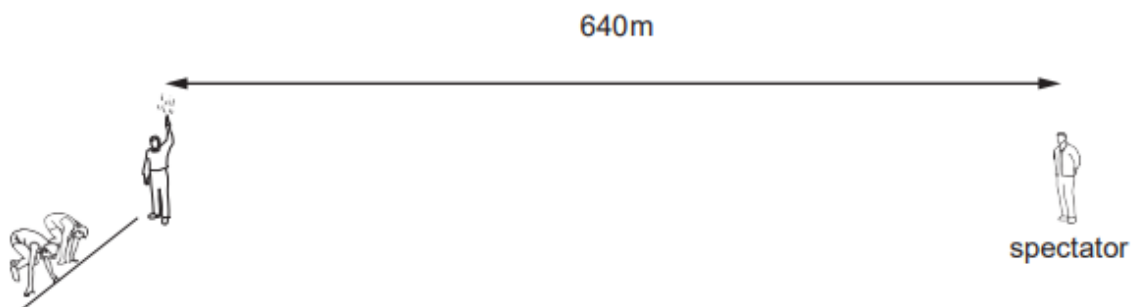
28.

An *acre* is a unit of land that is still in common use today. In medieval times it was defined as the area of land that could be ploughed in one day by a yoke of oxen. In imperial units it is traditionally defined as the area of one *chain* by one *furlong*. A furlong is 10 chains, and a chain is 20.1m long. What land area could a yoke of oxen plough in a week?

- A 201 m²
- B 1,407 m²
- C 4,040 m²
- D 28,281 m²

29.

A man holding a starting pistol stands 640 m away from a spectator.



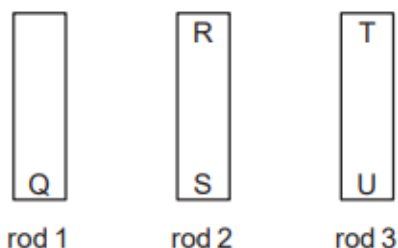
The spectator hears the sound of the starting pistol 2.0 s after seeing the flash from the pistol.

Using this information, what is the speed of sound in air?

- A 160m/s B 320m/s C 640m/s D 1280m/s

30.

The ends of three metal rods are tested by holding end Q of rod 1 close to the others in turn.



The results are as follows.

End Q: attracts end R,
 attracts end S,
 attracts end T,
 repels end U.

Which of the metal rods is a magnet?

- A. rod 1 only
B. rod 1 and rod 2
C. rod 1 and rod 3
D. rod 3 only.

SECTION B: *Biology Comprehension*

Read the following article and answer the questions relating to it that follow.



Fly agaric is a very distinctive fungus. In the autumn, it produces bright red toadstools with white spots. These toadstools are the fruiting bodies of the fungus which release vast numbers of tiny spores, just 10 μm (micrometres) in diameter. The spores are dispersed far and wide by the wind. If they settle in a suitable area they can grow into a new fungus.

The main body of the fungus is a network of thread-like structures called hyphae that grow underground. The hyphae release enzymes which break down any dead organic matter in the soil and leaf litter. The products of this digestion can be absorbed by the hyphae and used to help them grow. The fungus can also gain nutrition from trees by associating closely with their roots. Sugars pass to the fungus from the tree roots in exchange for minerals from the fungus. This is an example of a mutualistic symbiotic relationship.

Like many toadstools, fly agaric is poisonous to humans and lots of other animals. Eating it can cause sickness and even death. Nevertheless, people in some cultures deliberately consume the toadstool because of its psychoactive effects. The Sami people of northern Scandinavia, who traditionally herd reindeer, have been known to drink the urine of reindeer that have eaten fly agaric. This can induce hallucinations which may explain how the legend of Santa's flying reindeer came about!

1. What changes to environmental conditions, that occur in autumn, might trigger the growth of toadstools?

(2)

2. What is the diameter of a spore in mm? (1 mm = 1000 μm .)

Answer = mm
(1)

3. How does the process of digestion carried out by fungal hyphae compare with digestion carried out by humans? Describe one similarity and one difference.

(2)

4. Explain the meaning of the term *mutualistic symbiotic relationship*.

(2)

5. What organ in the body is affected if chemicals in fly agaric cause hallucinations?

(1)

6. Describe a method for measuring how poisonous different species of toadstool are. Consider what factors would need to be controlled for it to be a fair test.

(4)

7. Describe, in order, the parts of a reindeer's body that chemicals would have to pass through to get from its digestive system into its urine.

(2)

8. Explain whether you think fungi, like fly agaric, are more similar to plants or animals.

(2)

Section B: TOTAL = **/ 16**

SECTION C: Chemistry Experiment Question

Reaction of marble chips with different acids – the following data was acquired:

Table 1: Data *before* the experiment

Acid	Trial	pH Value (± 0.01)	Mass of Marble Chips (± 0.001) (g)	
Vinegar	1	3.11	33.725	
	2	3.12	41.030	
	3	3.16	39.111	
Coca-cola	1	2.78	43.148	
	2	2.74	30.978	
	3	2.78	55.728	
Lemon Juice	1	2.43	26.374	
	2	2.53	23.904	
	3	2.48	64.171	
Nitric Acid	1	1.52	59.582	
	2	1.61	33.812	
	3	1.54	33.835	
Sulfuric Acid	1	1.58	29.906	
	2	1.64	25.247	
	3	1.59	33.065	

Table 2: Data *after* the experiment (7 days later)

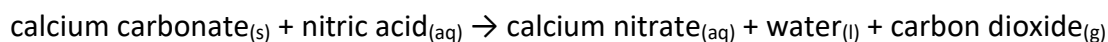
Acid	Trial	pH Value (± 0.01)	Mass of Marble Chips (± 0.001) (g)	Volume of solution (± 0.1) (cm^3)
Vinegar	1	5.63	30.601	70.0
	2	5.62	38.242	60.0
	3	5.56	36.303	60.0
Coca-cola	1	5.39	43.087	70.0
	2	5.42	30.808	75.0
	3	5.44	55.685	70.0
Lemon Juice	1	5.84	25.228	65.0
	2	6.05	22.547	65.0
	3	6.01	62.014	65.0
Nitric Acid	1	7.20	59.103	65.0
	2	7.63	33.328	65.0
	3	7.60	33.083	65.0
Sulfuric Acid	1	2.38	29.666	73.0
	2	2.42	25.129	75.0
	3	2.39	32.916	73.0

Table 3: Difference in values from before and after the experiment.

Acid	Trial	Change in		
		pH Value (± 0.01)	Mass of Marble Chips (± 0.001) (g)	Volume of solution (± 0.1) (cm^3)
Vinegar	1	2.52	3.124	30.0
	2	2.50	2.788	40.0
	3	2.40	2.808	40.0
Coca-cola	1	2.61	0.061	30.0
	2	2.68	0.170	25.0
	3	2.66	0.043	30.0
Lemon Juice	1	3.41	1.146	35.0
	2	3.52	1.357	35.0
	3	B	2.157	35.0
Nitric Acid	1	5.68	0.479	35.0
	2	6.02	A	35.0
	3	6.06	0.752	35.0
Sulfuric Acid	1	0.80	0.240	27.0
	2	0.78	0.118	25.0
	3	0.80	0.149	27.0

In this question you will analyse the collected experimental data and draw conclusions from the results of an experiment designed to investigate the reaction of marble with different acids.

Marble is a form of calcium carbonate. Its reaction with nitric acid can be represented as:



The acids used in this experiment include some 'everyday' acids and some laboratory acids. These are:

- coca-cola
- vinegar
- lemon juice
- nitric acid
- sulfuric acid

At the start of each experiment, a beaker was filled with 100.0 cm^3 of acid solution, and the pH was measured. Then, a known mass of marble chip was added. This was repeated three times for each acid. The beakers were left for 7 days before the new readings were taken:

This is what was measured:

- mass of marble chips
- volume
- pH

Experimental technique

1. At the start of each experiment, the beakers were filled with 100.0 cm^3 of the respective acid solution.

What is 100.0 cm^3 in litres? [1 cm^3 is equivalent to 1 mL].

(1)

2. Why do you think it is not possible to use exactly the same mass of marble chip in each experiment?

(1)

3. This experiment can reveal the ability of each acid to react with marble chips.

Why does it **not** directly compare the strength of each acid?

(1)

4. Suggest two variables - other than time - that should be kept constant during the experiments.

(2)

5. One student suggested using tongs to remove the marble chips from the acid at the end of the experiment. State one problem with using tongs and state which technique you would use instead.

(2)

6. Suggest two observations that would be made during this reaction

(2)

Data Interpretation and analysis

7. Why was the experiment repeated three times for each acid?

(1)

8. Which is the most acidic solution at the start of the reaction?

(1)

9. Some fashionable kitchen worktops are made from marble so it is important to understand how acids found in a kitchen will interact with it.

Comparing vinegar, coca-cola, lemon juice, which:

a) showed the largest pH change of the acid?

(1)

b) reacted with the most amount of carbonate?

(1)

10. Why can an average value for the three trial runs not be used in this experiment?

(1)

11. Calculate the missing values A and B, from **table 3**.

A = B =

(2)

12. Refer to the values recorded for vinegar to describe the relationship between the mass of marble chip, and the volume of solution.

(1)

Whenever an experiment is carried out, steps are always taken to ensure the results are as reliable as possible as well as recognising where there are limitations - where readings are not perfect. This is called experimental uncertainty which can be expressed using a \pm sign. For example, measuring volumes of liquids in a measuring cylinder is not perfect. The values are recorded as being accurate to $\pm 0.1 \text{ cm}^3$.

13. Give the range of values possible for a volume (measured using a measuring cylinder) of 72.7 cm^3 .

(1)

14. Is the range of error smaller or larger than the error of the mass readings?

(1)

Section C: TOTAL = **/ 19**

SECTION D: *Physics Problem Solving*

Read the paragraph below and use the information to help answer the questions that follow. Information and answers from the earlier parts of this question may help in answering later parts. Numerical answers should be given to two significant figures.

When a force, F , acts perpendicularly on an area, A , we say that a pressure, p , is exerted over that area according to the formula $p=F/A$. If F is measured in newtons (N) and A in metres squared (m^2), then p is in pascals (Pa).

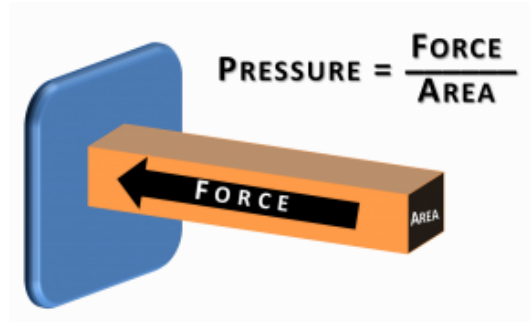


Image credit: <http://www.aaronswansonpt.com/basic-biomechanics-pressure/>

There are many types of forces that can cause such a pressure. One such force is the *weight*, W , of an object, which, when on Earth, is the force caused by the Earth's gravitational pull on the mass, m , of the object. The weight of the object is straightforward to calculate and is given by $W=m \times g$, where g is a quantity called the 'gravitational field strength' of the Earth. The gravitational field strength of the Earth is a measure of how strongly the Earth pulls on 1 kg of mass. The direction of the weight is vertically downwards, towards the centre of the Earth.



Image credit: <http://msclantonsphysicalsciencepage.weebly.com/the-direction-of-weight.html>

The mass of an object is a measure of how much 'stuff' (particles) the object is made of. It is connected to the size of the object – specifically, its *volume* V – via its density ρ : $\rho=m/V$. If mass is expressed in kg and volume in m^3 then density is given in kg/m^3 . If mass is expressed in g and volume in cm^3 then density is given in g/cm^3 .

Questions:

1. What does the word perpendicular mean in this case?

(1)

2. If a 7.0 N force acts over an area of $20\text{ cm} \times 0.15\text{ m}$, what pressure, in pascals, does it generate?
Reminder: give your answer to two significant figures.

(2)

3. A man has a mass of 85 kg and is standing on the surface of the Earth which has a gravitational field strength of $g = 10\text{ N/kg}$. What is the weight of this man, in newtons, and what is the direction of this force?

(2)

4. A cylinder of wood has a circular cross-section, as in the picture below. The volume of a cylinder is 'cross-sectional area x length' and the formula for the cross-sectional area of a circle is $A = \pi r^2$, where r is the *radius* of the circle. If the cylinder has a diameter of 5.0 cm and a length of 12 cm , calculate its volume in cm^3 .



Image credit: <https://www.mathsisfun.com/geometry/cylinder.html>

(1)

5. Mr P is considering installing a circular swimming pool with a diameter of 3.6 m and which is 0.9 m high. If the density of water is 1000 kg/m^3 , and the swimming pool is filled to the brim, what mass of water is contained in the pool?



Image credit: <https://mountfield-export.com/products/azuro-300-3-6-x-0-9-m/>

(2)

6. A builder, Mr B, thinks that the ground around the house could become unstable if a pressure of more than 7.8 kPa is exerted on it ($1\text{ kPa} = 1000\text{ Pa}$). Why does the filled pool exert a pressure on the ground?

(2)

7. Calculate the pressure that the filled pool exerts on the ground. Should Mr P be concerned?

(3)

8. Mr P notices that the same company makes a similar pool which has the same height but a diameter of 2.4 m , which he thinks might help. What pressure does this exert on the ground? Will it help?

(3)

9. From your answers to 7 and 8, can you say anything about how the pressure seems to change with a change in cross-sectional area of water?

(1)

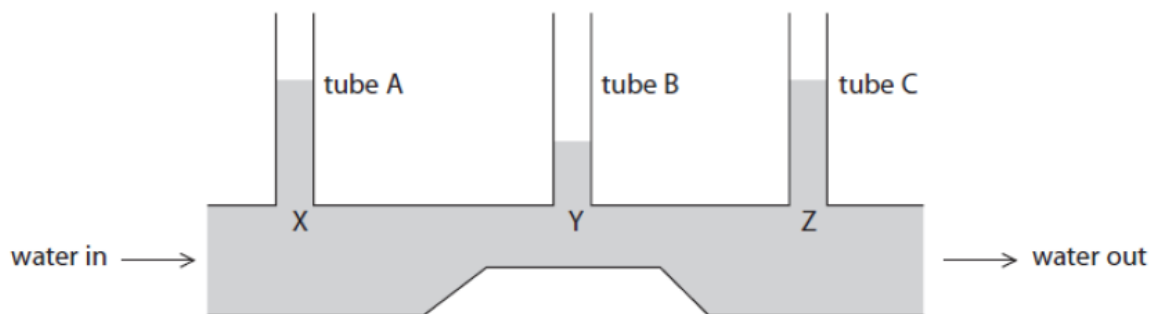
10. Disappointed, Mr P thinks he may as well stick with the original swimming pool but not fill it as high. What is the maximum height of water he could use if the ground is not to become unstable?

(3)

11. What physical dimension of the water *does* the pressure seem to depend on?

(1)

12. A scientist uses the apparatus below to investigate pressure in a fluid. The apparatus consists of three tubes, *each with the same diameter*, attached to a pipe below whose diameter varies as shown. How would you expect the pressure in the water at point Y to compare with the pressures at X and Z? Explain your answer.



(1)

13. The scientist passes a constant flow of water through the pipe at the bottom. How would you expect the *speed* of the water at Y to compare with the speeds of the water at X and Z? Explain your answer

(1)

14. Using your answers to the previous two questions, what could you say about the relationship between pressure and speed in a liquid?

(1)

15. Wingtip vortices are circular patterns of rotating air left behind a wing as it generates lift. The picture below uses coloured smoke to visualise one such vortex. The air in vortices travels fastest near the centre of the vortex and slowest near the edge. Using what you have discovered in this question, along with any other scientific knowledge and understanding you possess, briefly discuss how this might be related to vapour trails in the atmosphere.



Image credit: https://en.wikipedia.org/wiki/File:Airplane_vortex_edit.jpg

(1)

Section D: TOTAL = / 25