

# ENTRANCE SCHOLARSHIPS EXAMINATION 2022

# 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 translitering the Greek.
  - (a) Βελλεφοφων
  - (b) Πεοσευς
  - (c) Πανδωρα
  - (d) Ιοις
  - (e) Ήφαιστος

[5]

- 2 Transliterate the following English into Greek (i.e. write them in Greek letters). Long vowels (eta, omega, etc.) are indicated with a mark (e.g. 'ê' or 'ô'). Remember to add breathings where appropriate.
  - (a) Hestia
  - (b) Kyklôpes
  - (c) Polyphêmos
  - (d) Argos Panoptês
  - (e) Kerberos

[5]

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

**Example:**  $\tau \circ \upsilon \varsigma \delta \circ \upsilon \lambda \circ \upsilon \varsigma = \tau \circ \upsilon \delta \circ \upsilon \lambda \circ \upsilon$  (slave)

- (a) τας ὀργας
- (b) των φοβων
- (c) οί γεφοντες
- (d)  $\tau \alpha \, \tilde{\alpha} \theta \lambda \alpha$
- (e) τοις συμμαχοις

[10]

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

- (a) τον έτοιμον
- (b) ή νυξ
- (c) της νεως

[6]

[10]

- 5 Change the following verbs from single to plural, or plural to single, keeping the <u>same</u> person and tense. <u>Then translate your answer</u>.
  - (a) παρεστιν
  - (b) κούψετε
  - (c) παρασκευάζομεν
  - (d) εὗοεν
  - (e) ἀπέθανες

# 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) eureka!
- (b) cryptic
- (c) plutocratic
- (d) xenophobia
- (e) athlete
- (f) hydroelectricity

[6]

## 7 Write out any TWO of the following:

- (a) The full future of  $\lambda \epsilon i \pi \omega$ .
- (b)  $2^{nd}$  declension noun τό ὕδωρ in all its cases (singular & plural).
- (c) Decline the pronouns  $\dot{\epsilon}\gamma\dot{\omega}$  and  $\dot{\eta}\mu\epsilon\tilde{\iota}\varsigma$ .
- (d) The feminine definite article (singular & plural). [8]

# SECTION B: Sentences and Composition (35 marks)

1	Translate into English:	
	(a) ὁ πατηϱ ἐθελει κϱύπτειν τα χϱήματα ἐν τῃ ἀγοϱգ.	[4]
	(b) ὁ βασιλεύς μιαν ἡμεǫαν ἐν τῃ πολει μενει, ἐπειτα ἀποτǫεχει εἰς	ἀλλην. <b>[5]</b>
	(c) τίς ἐστιν ὁ ἀνηϱ ὁ μετα τῶν φιλῶν;	[3]
	(d) ὁ πλούσιος τον φυλακα των χρηματων ἐδιωκεν.	[4]
	(e) δύο παιδες ἐν τη νησῷ εἰσιν.	[4]

## 2 Translate into Greek:

(a)	The allies stops the shameful war.	[5]
(b)	The only stranger in the city was a messanger.	[5]
(c)	We want to send prizes to the camp.	[5]

#### SECTION C: Translation (30 marks)

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

## A average day in the life of Socrates, the Athenian philosopher.

ή μὲν <u>Ξανθίππη πολλάκις</u> λέγει · "<u>ἴθι δή"</u> καὶ τὸν Σωκǫάτην ἐκ τοῦ οἴκου πεμπει. ἔπειτα δὲ, ὁ Σωκǫάτης ποὸς τὴν ἀγοǫὰν <u>βǫαδέως</u> βαίνει. ὁ δὲ Σωκǫάτης <u>χαίǫει</u> βαίνειν <u>ἐκεῖσε</u> διότι ὁ Σωκǫάτης φιλεῖ μετὰ τῶν φιλῶν λέγειν. ἐν γὰǫ τῆ ἀγοǫῷ ὁ Σωκǫάτης <u>πεοὶ</u> τὰ καλὰ καὶ ἀγαθὰ λέγει. ὁ ἀλλὰ οὐ φιλεῖ <u>πονεῖν κατ'</u> οἶκον. ὁ μὲν Σωκǫάτης ἐν τῆ ἀγοοῷ πάǫεστι <u>καθ' ἑκάστην</u> τὴν ἡμέǫαν · οἱ δὲ φιλοί ἀκούειν φιλοῦσιν. ὁ μὲν Σωκǫάτης <u>μάλιστά</u> ἐστι σοφός · ὁ δὲ οὐ μάλιστα καλός.

ό οὖν Σωκǫάτης <u>ήδέως</u> βαίνει πǫὸς τὴν ἀγοǫάν. <u>δι 'ὀλίγου</u> βλέπει τὸν <u>Ἀλκιβιάδην</u> μετὰ τοῦ <u>κυνός</u>, Ἄǫγου. ὁ Ἀǫγος παǫὰ τὸν δεσπότην ἡδέως <u>καθίζει</u>. ὁ Ἀλκιβιάδης νέος καὶ καλός ἐστιν. ἀλλὰ ἥ γε Ξανθίππη (ἡ τοῦ Σωκǫατούς γύνη) τὸν Ἀλκιβιάδην οὐ φιλεῖ · ὁ γὰǫ μὲν Ἀλκιβιάδης ἐστὶ <u>ἑάθυμος</u> καὶ ὁ δὲ αἰεί <u>φλυάǫει</u>. ἀλλὰ ὁ Σωκǫάτης τὸν Ἀλκιβιάδην φιλεῖ. ὁ γὰǫ μὲν Ἀλκιβιάδης ἐστὶ σοφός · ὁ δὲ μάλιστα καλός. ὁ μέντοι Ἀλκιβιάδης ἐστὶ τε νέος καὶ πολλάκις ἀνόητος. ὁ οὖν Σωκǫάτης ἐστὶν ὁ τῷ Ἀλκιβιάδη διδάσκαλος.

## Vocabulary:

πολλάκις	adv. often	ήδέως	with pleasure
"ἴθι δή"	"get lost!"	δι 'ὀλίγου	soon
βραδέως	slowly	βλέπω	I see
χαίζει	he enjoys	ό κύων, -ονος	a dog
ἐκεῖσε	there	καθίζω	I sit
πεϱὶ	prep., regarding	<b>ἑ</b> άθυμος	lazy
κατ' / καθ'	prep. at / during	φλυάρω	I talk nonsense
πονεῖν	to work	ἀνόητος	foolish, silly
ἑκάστος, -η, -ον	each		
μάλιστά	<i>adv</i> . very		

## Names

ή Ξ <i>α</i> νθίππη	Xanthippe, Socrates' wife
ό Σωκράτης	Socrates, the great philosopher
ὁ Ἀλκιβιάδης	Alcibiades, a famous Athenian, and friend of Socrates
Άργος	the name of Alcibiades' dog

# HARROW SCHOOL



# ENGLISH SCHOLARSHIP EXAM 2022

## I<sup>1</sup>/<sub>2</sub> 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 <u>a new piece of paper</u>.

#### **SECTION A: WRITING**

Imagine that you would like to start a new club or society at school. You need to write a letter to the Head Teacher, persuading them that you should be given permission to start this club or society. You need to explain to them how it will be educationally beneficial.

Write this letter, proving an outline of the activities of your planned club or society, and why you think it would benefit the other pupils. Aim to use engaging and persuasive writing to make your letter as interesting as possible.

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**

# Read the following excerpt from The Little Stranger by Sarah Waters and answer the question that follows.

I first saw Hundreds Hall when I was ten years old. It was the summer after the war, and the Ayreses still had most of their money then, were still big people in the district. The event was an Empire Day fête: I stood with a line of other village children making a Boy Scout salute while Mrs Ayres and the Colonel went past us. They must have made a very handsome family, but my memory of them is vague. I recall most vividly the house itself, which struck me as an absolute mansion. I remember its lovely ageing details: the worn red brick, the cockled window glass, the weathered sandstone edgings. They made it look blurred and slightly uncertain—like an ice, I thought, just beginning to melt in the sun.

There were no trips inside, of course. The doors and French windows stood open, but each had a rope or a ribbon tied across it; the lavatories set aside for our use were the grooms' and the gardeners', in the stable block. My mother, however, still had friends among the servants, and when the tea was finished she took me quietly into the house by a side door, and we spent a little time with the cook and the kitchen girls. The visit impressed me terribly. The kitchen was a basement one, reached by a cool vaulted corridor with something of the feel of a castle dungeon. An extraordinary number of people seemed to be coming and going along it with hampers and trays. The girls had such a mountain of crockery to wash, my mother rolled up her sleeves to help them; and to my very great delight, as a reward for her labour I was allowed to take my pick of the jellies and 'shapes' that had come back uneaten from the fête.

But then came an even greater treat. High up on the wall of the vaulted passage was a junctionbox of wires and bells, and when one of these bells was set ringing, calling the parlourmaid upstairs, she took me with her, so that I might peep past the green baize curtain that separated the front of the house from the back. I could stand and wait for her there, she said, if I was very good and quiet. I must only be sure to keep behind the curtain, for if the Colonel or the missus were to see me, there'd be a row.

I was an obedient child, as a rule. But the curtain opened onto the corner junction of two marble-floored passages, each one filled with marvellous things; and once she had disappeared softly in one direction, I took a few daring steps in the other. The thrill of it was astonishing. I don't mean the simple thrill of trespass, I mean the thrill of the house itself, which came to me from every surface—from the polish on the floor, the patina on wooden chairs and cabinets, the scroll of a frame. I was drawn to one of the dustless white walls, which had a decorative plaster border, a representation of acorns and leaves. I had never seen anything like it, outside of a church, and after a second of looking it over I did what strikes me now as a dreadful thing: I worked my fingers around one of the acorns and tried to prise it from its setting; and when that failed to release it, I got out my penknife and dug away with that. I didn't do it in a spirit of vandalism. I wasn't a spiteful or destructive boy. It was simply that, in admiring the house, I wanted to possess a piece of it—or rather, as if the admiration itself, which I suspected a more ordinary child would not have felt, entitled me to it. I was like a man, I suppose, wanting a lock of hair from the head of a girl he had suddenly and blindingly become enamoured of.

#### Explore the presentation of the narrator's thoughts and feelings about Hundreds Hall in this extract.

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



# **French Scholarship Examination 2022**

# 60 Minutes

- Section 1 : Text and reading comprehension
- Section 2 : Text and retranslation
- Section 3 : Translation into French
- Section 4 : 200-word response in French

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

À la même époque, j'ai rencontré un docteur nommé Jean Puyaubert. Je croyais que j'avais un voile aux poumons. Je lui ai demandé de me signer un certificat pour éviter le service militaire. Il m'a donné un rendez-vous dans une clinique où il travaillait, place Alleray, et il m'a radiographié : je n'avais rien aux poumons, je voulais me faire réformer et, pourtant, il n'y avait pas de guerre. Simplement, la perspective de vivre une vie de caserne comme je l'avais déjà vécue dans des pensionnats de onze à dixsept ans me paraissait insurmontable.

Je ne sais pas ce qu'est devenu le docteur Jean Puyaubert. Des dizaines d'années après l'avoir rencontré, j'ai appris qu'il était l'un des meilleurs amis de Roger Gilbert-Lecomte et que celui-ci lui avait demandé, au même âge, le même service que moi : un certificat médical constatant qu'il avait souffert d'une pleurésie – pour être réformé.

• E	xample : I learnt	j'ai appris
1. H	e had suffered	
<b>2.</b> H	e gave me	
3. I	had nothing	
4. O	ne of the best friends	
5. T	here was not	
6. I	asked him	
7. A	fter meeting him	
8. A	t the same time	
9. I'	d already experienced it	
10.H	e X-rayed me	

(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

*J'ai appris* : I learnt → We did not learn : **Nous n'avons pas appris** 

1. Je croyais que j'avais : I thought that I had

 $\rightarrow$  He thought that we had :

2. *Je voulais me faire réformer* : I wanted to be declared unfit for military service

 $\rightarrow$  You (use 'tu') wanted to be declared unfit for military service :

- 3. *J'avais un voile aux poumons* : I had a shadow on my lungs
  → You (use 'vous') did not have a shadow on your lung :
- 4. *Je ne sais pas ce qu'est devenu le docteur* : I don't know what became of the doctor

 $\rightarrow$  Do you (use 'tu') know what became of him ? :

5. Une clinique où il travaillait : a clinic where he used to work
→ The clinic where they (use 'ils') no longer worked :

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

- a) We get up. (se lever)
- b) They will attend the show. (assister à)
- c) You (tu) would take the coach. (prendre)
- d) It is never cold (weather). (faire)
- e) Anne has not gone out. (sortir)
- f) You (vous) have never read the book. (lire)
- g) She had already gone there. (aller)
- h) We are not going to work hard. (aller + infinitif)
- i) They danced last night. (danser)
- j) She writes me letters. (écrire)

(30 marks)

**4.** You are writing an article in French for your school website talking about a summer job. It can be a true or imaginary account.

You will mention 1) how you like to relax in the summer; 2) a job that you did last summer to earn some money; 3) the advantages and disadvantages of working; 4) where you will go in future during the holidays.

Answer in the spaces provided. Aim to write 40-50 words per question. Do not exceed 200 words in total (focus on accuracy rather than quantity) -40 marks.

1. Comment aimes-tu te relaxer pendant les vacances d'été?

2. Décris un job que tu as fait pendant les dernières vacances d'été.

3. Quels sont les avantages et inconvénients de travailler pendant les vacances ?

4. Où partiras-tu en vacances à l'avenir et pourquoi ?



# **Geography Scholarship Examination 2022**

# **60 Minutes**

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

Sections 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]

## [Total: 10 marks]

	1.	State the difference between weathering and erosion.	[2 marks]
•••••	•••••		
••••	• • • • • • • •		••••••

2.	Outline how waves can build up beaches at the coast.	[2 marks]
••••••		••••••

Study Figure 1, a sketch map showing features of coastal deposition.



Using Figure 1 and your own knowledge, explain how different landforms may be created by the transport and deposition of sediment along the coast. *You may use diagrams and/or annotate the Figure to support your response.* [6 marks]


#### **Extra Space**

.....

END OF QUESTION 1

#### [spend 15 minutes on this section]



Study Figure 2, employment structures of selected countries (Source: CIA World Factbook)

#### 4. State the difference between **secondary** and **tertiary** employment type. [2 marks]

Using Figure 2, suggest how employment structure might change in India or Kenya over the next fifty years. [3 marks]

Explain the link between the level of economic development and employment structure in at least two countries identified in Figure 2. [5 marks]

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

7. Choose <u>one</u> agent of erosion you have studied. Illustrate the impacts it has on the physical landscape.

#### OR

8. Using at least one example, discuss:

(a) how and why individual settlements grow and
(b) why some, in time, decline.

OR

9. Discuss the extent to which the climate of the British Isles is influenced most greatly by latitude.

(20)
OR

10. Using an example, discuss the extent to which urban development can be managed to achieve only positive outcomes.

[20]

[20]

Space to plan your answer:


[Total: 20 marks] [Exam Total: 40 marks]

END OF EXAMINATION



# **History Scholarship Examination 2022**

# 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 **<u>both</u>** questions.

#### **Background information**

World War I came to an end as a consequence of the Armistice (ceasefire) agreed on 11 November 1918. Soon after this peace negotiations got under way in Paris. When, in June 1919, the German delegation in Paris finally accepted the peace treaty, known as the Treaty of Versailles, there was an immediate outcry from Germany. Although the Germans already knew that Georges Clemenceau (Prime Minster of France 1917-1920) wanted revenge and that David Lloyd George (Prime Minster of Great Britain 1916-1922) had won an election in 1918 promising to punish Germany harshly, they were angry and horrified. Many Germans refused to accept that their army had been defeated, claiming that it had been 'stabbed in the back' by civilians in Germany. This led to the claim that they should not be treated in the peace negotiations as a defeated country. They also saw the treaty as a Diktat (an order imposed on someone without their consent), breaking the Fourteen Points (a plan put forward to achieve peace by Woodrow Wilson - President of the USA 1913-1921), and they found it impossible to accept the idea of war guilt, which underpinned the payment of reparations (compensation paid for war damage by a defeated state).

Could German criticism of the Treaty of Versailles be justified?

#### Source A: Lloyd George speaking in Parliament in July 1919.

The terms are in many respects terrible terms to impose upon a country but Germany not merely provoked, but planned the most devastating war the earth has ever seen. Germany deliberately embarked upon it to increase its power at the expense of its neighbours. I cannot think of a worse crime.

The aim of the Treaty is to force Germany, in so far as it is in her power, to restore, to repair and to redress. Yes, and to take every possible precaution of every kind that is in our power against the recurrence of another such crime.

# Source B: From a document written by Lloyd George in March 1919 during the peace negotiations.

#### SECRET

#### Some considerations for the Peace Conference

It is easy to patch up a peace which will last for thirty years. What is difficult is to draw up a peace which will not provoke a fresh struggle when those who took part in the war have passed away. You may strip Germany of her colonies, reduce her armaments to a mere police force and her navy to that of a fifth-rate power but if she feels that she has been unjustly treated, she will find ways of getting revenge. Our terms can be so just that Germany will feel in its heart that it has no right to complain. But injustice or arrogance displayed in the hour of triumph will never be forgiven or forgotten. For those reasons I am strongly opposed to transferring more Germans to rule of another nation than can be possibly helped. If we are wise we will do everything possible to enable the German people to get upon their legs again.

#### **Questions**

#### Question 1

Study Source A. Explain in your own words why David Lloyd George (Prime Minster of Great Britain 1916-22) claims that the terms of the Treaty of Versailles (the peace treaty agreed with Germany after the conclusion of World War I) were intended 'to take every possible precaution of every kind that is in our power against the recurrence of another such crime'. [10 marks]

#### Question 2

Study Sources A and B. How and why do these documents suggest that David Lloyd George was unsure of the most effective way to punish Germany at the end of the Great War? [20 marks]

#### **SECTION B**

#### Answer ONE of these questions.

Either

3. 'It is only useful to study History after 1900; everything before this point is irrelevant.' How far do you agree with this statement? Explain your answer.

or

4. 'Women have been more important in determining the course of History than men.' How far do you agree with this statement? Explain your answer.

#### SECTION C

5. Study the two images below. What information do these two sources provide about life in Africa in about 1600? [30 marks]



# Source C

A 16<sup>th</sup> Century Pendant Mask from Nigeria. This was produced by the Edo peoples (court of Benin) in west Africa.

## Source D

A mosque in the city of Djenné, Mali (West Africa) first built in the 13<sup>th</sup> century.





#### ENTRANCE SCHOLARSHIPS EXAMINATION 2022

#### 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**

#### The defeat of Pompeius the Great in the Civil War, and his betrayal and murder in Egypt.

olim Caesar in Graeciam transivit, et contra Pompeium cum militibus multis pugnavit. primo proelio Caesar victus est; effugere poterat Caesar quod, nocte interveniente, Pompeius sequi noluit. Caesar tum dixit Pompeium nescire vincere, et illo solo die se posse superari. deinde duo imperatores apud <u>Pharsalum</u>, ductis ingentibus exercitibus, <u>dimicaverunt</u>. numquam <u>adhuc</u> Romani milites maiores in unum locum convenerant, qui totum terrarum <u>orbem</u> facile superare poterant, si contra barbaros ducti erant. omnes ferociter in magno bello pugaverunt, et tandem victus est Pompeius, et castra eius capta sunt. ipse, fugiens Alexandriam, rogavit ut rex Aegypti auxilium daret. sed ille, qui pecuniam, non <u>amicitiam</u> voluit, necavit Pompeium ut praemium a Caesare acciperet; caput eius et <u>anulum</u> Caesari misit. hoc conspecto, Caesar <u>lacrimabat</u>, quod vidit tanti viri caput, et <u>generi</u> olim sui.

Names	
Pharsalus, 2f.	Pharsalus, a town in Greece
Alexandriam 1f.	Alexandria, a city in Egypt
Vocabulary	
dimico, dicimare	to fight it out
adhuc	up to that time, before
gener, generi 2m.	son-in-law (Pompey had been married to Caesar's daughter)
orbs, orbis 3m	globe, orb
amicitia 1f.	friendship
anulus, 2m.	ring
lacrimo, -are	to cry, to weep

#### Translate the passage into good English.

Use alternate lines.

[30 marks]

#### Section 2: Comprehension

A battle for a hill during the civil war between Caesar's men, and those of Afranius and Petreius.

erat inter <u>oppidum Ilerdam</u> et parvum <u>collem</u>, ubi castra <u>Petreius</u> et <u>Afranius</u> castra habebant, <u>planities passuum</u> CCC. in hoc loco <u>tumulus</u> erat altior. si Caesar hunc collem <u>occupavit</u>, credebat se hostes facilius superaturum esse. igitur, legiones III ex castris eduxit, et acie in locis idoneis instructa, iussit <u>antesignanos</u> currere et illum tumulum occupare. ubi hoc Afranius vidit, celeriter <u>cohortes</u>, quae pro castris erant, misit ut locum occuparent. in proelio pugaverunt et, quod prius milites Afranii venerant, milites Caesaris repelluntur, et fugere coguntur.

#### Names

llerda 1f	Ilerda, a town in Spain
Petreius / Afranius 2m	Marcus Petreius, and Lucius Afranius,
	two Roman politicians and generals on Pompey's side.
Vocabulary	
oppidum, n.	town
collis, 3m.	a hill
planities, 5f.	a plain, open ground
passus, 4f.	a step, a foot.
tumulus, 2m	a tumulus, a hill
occupo, -are	to occupy, to control
antesignanus, 2m	vanguard, front lines
cohortes, pl. f.	cohorts, subdivisions of a legion

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

1.	In line 1, where did Petreius and Afranius have their camps?	[2]
2.	How big was the open plain between them?	[2]
3.	What was in the middle of this open ground?	[1]
4.	What did Caesar believe would happen, if he occupied this hill?	[3]
5.	How many legions did Caesar lead out of his camp?	[1]
6.	What did Caesar order his men to do, after they formed battle lines?	[4]
7.	What did Afranius order his men to do in response?	[3]
8.	Whose soliders made it to the tumulus first?	[1]
9.	What was the result to the other side?	[3]

[20 marks]

#### Section 3: Grammar

#### The defeat of Pompeius the Great in the Civil War, and his betrayal and murder in Egypt.

olim Caesar in Graeciam transivit, et contra Pompeium cum militibus multis pugnavit. primo proelio Caesar victus est; effugere poterat Caesar quod, nocte interveniente, Pompeius sequi noluit. Caesar tum dixit Pompeium nescire vincere, et illo solo die se posse superari. deinde duo imperatores apud <u>Pharsalum</u>, ductis ingentibus exercitibus, <u>dimicaverunt</u>. numquam <u>adhuc</u> Romani milites maiores in unum locum convenerant, qui totum terrarum <u>orbem</u> facile superare poterant, si contra barbaros ducti erant. omnes ferociter in magno bello pugaverunt, et tandem victus est Pompeius, et castra eius capta sunt. ipse, fugiens Alexandriam, rogavit ut rex Aegypti auxilium daret. sed ille, qui pecuniam, non <u>amicitiam</u> voluit, necavit Pompeium ut praemium a Caesare acciperet; captus eius et <u>anulum</u> Caesari misit. hoc conspecto, Caesar <u>lacrimabat</u>, quod vidit tanti viri caput, et <u>generi</u> olim sui.

#### Names

Pharsalus, 2f.	Pharsalus, a town in Greece
Alexandriam 1f.	Alexandria, a city in Egypt

#### Vocabulary

dimico, dicimare	to fight it out
adhuc	up to that time
gener, generi 2m.	son-in-law (Pompey had been married to Caesar's daughter)
orbs, orbis 3m	globe, orb
amicitia 1f.	friendship
anulus, 2m.	ring
lacrimo, -are	to cry, to weep

- 1. Find an adjective in line 1.
- 2. What case is *nocte* in line 2?
- 3. What tense is *noliut* in line 3?
- 4. What case is *illo solo die* in line 3, and why is it in this case?
- 5. What case is *unum locum* in line 5, and why is it in this case?
- 6. What case is *magno bello* in line 6-7?
- 7. What tense is *rogavit* in line 8?
- 8. Identify a verb in the passive voice.
- 9. Identify a reflexive pronoun.
- 10. Identify a noun in the dative case.
- 11. Identify an ablative absolute from the passage.
- 12. Identify a preposition in line 6.
- 13. acciperet in line 9 is in the subjunctive mood. Why?

[15 marks]
Surname:	

First name:

Current School:



# MATHEMATICS PAPER 1 SCHOLARSHIP EXAMINATION 2022



## **Instructions to Candidates**

- Use BLACK ink only.
- Calculators and geometrical instruments may be used.
- Show all your working. Answers with no working may not score full marks.
- Write your answer to each question in the space following the question.

## **Information for Candidates**

- The marks available for each question are indicated in square brackets.
- Full marks may be obtained for answers to ALL questions.
- This paper has **20** questions.
- The total number of marks available is **100**.

## Section A (55 marks)

1. Write the number 8.649703 to

(ii) 4 significant figures

(i) 2 decimal places

- 2. (i) One bus leaves the bus station every 15 minutes. Another bus leaves every 12 minutes. At 11:30 am both buses leave the bus station. At what time will this next happen?

## ......(1)

(ii) Philippa wants to tile her bathroom wall. It measures 1.2 m by 2.16 m. She finds square tiles with a side length of 10 cm, 12 cm, or 18 cm. Only one of these tiles fit the wall exactly. Which and, how many will she need?

- 3.  $a = \frac{v-u}{t}$ 
  - (a) Work out *a* when v = 35, u = 17, t = 2.5

(b) Work out t when v = -7.25, u = -23.75, a = 3.3

(c) Work out *u* when a = -9.8, v = -12, t = 1.2

4. (a) Simplify fully  $\frac{x}{3} + \frac{x}{4}$ 

(b) Express as a single fraction

$$\frac{y}{2} - \frac{y+1}{7}$$

(c) Express as a single fraction

$$\frac{2}{w-2} - \frac{3}{w}$$

5. (a) Solve 
$$2x - 2(2x - 3) = 3 - 2(2 - x)$$

(b) Solve 
$$\frac{x}{4} - \frac{2x-1}{3} = 5$$

(d) Solve 
$$\frac{1}{x} + \frac{2}{3x} = 5$$
 (3)

(e) Solve 
$$\frac{1}{3}(2-y)^2 = \frac{27}{4}$$
 (3)

6. (a) Factorise 6s + 10x

7.

- (b) Factorise fully  $9m^2 12mp$  ......(1) (c) Factorise fully  $\frac{15}{4} x^3 y^2 - \frac{3}{4} x^2 y^3$  .....(1) (a) Make *a* the subject of  $S = ut + \frac{1}{2} at^2$ 
  - (b) Make y the subject of  $c = w - 4ay^3$ (b) Make y the subject of

$$\frac{1}{v} - \frac{1}{f} = \frac{1}{u}$$

8. (a) On the axes below draw y = 2x - 4 and 2x + 3y = 12.



(4)

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

9. Solve the following simultaneous equations y - 2x + 5 = 04x - 5y = 13

## Section B (45 marks)

10. (a) A tourist attraction experienced a 3.75% fall in visitor numbers in June, compared to the previous month, due to exceptionally bad weather. There were 121 660 visitors in June. How many visitors were there in May?

(b) In July there were 4.5% more visitors than in May.What was the percentage increase in visitor numbers from June to July? Give your answer correct to 1 decimal place.

11. Johny bought a handbag in Paris. The handbag cost €62.30 In London, the same type of handbag costs £52.50

The exchange rate was  $\pounds 1 = \pounds 1.17$ 

(a) Compare the cost of the handbag in Paris with the cost of the handbag in London.

(b) Johny's friend, Joss also bought the same type of handbag when he was holidaying in New York. He paid \$69.99.

If the exchange rate from Pound Sterling to US dollar was  $\pounds 1 = \$1.33$ . How much is Joss's handbag in Euro ( $\bigcirc$ ), to the nearest hundredth?

12. AB is parallel to CD.



Not drawn accurately

Work out the value of x.

13. The perimeter of the triangle is the same as the perimeter of the square. The lengths are given in centimetres.



Calculate the area of the square, giving your answer in exact fractions.

(b) Here are two straight lines, ABCDE and PQ.

Diagrams NOT accurately drawn



In the diagram, all the lengths are in cm. AE = 2 PQ. Find an expression, in terms of x, for the length of DE.

Give your answer in its simplest form.

15. A set of six numbers have a median of 5. All the numbers are even. The range of the numbers is 6. The mode of the numbers is 4.

Write down a possible set of six numbers.

16. If I double the radius and triple the height of a cone. How many times is the new volume compared to its original? [Volume of a cone =  $\frac{1}{3}\pi r^2 h$ ]



- 17. Look at this pattern
  - $1^{2} 0^{2} = 1$   $2^{2} 1^{2} = 3$   $3^{2} 2^{2} = 5$   $4^{2} 3^{2} = 7$   $\vdots$   $\vdots$   $\vdots$
  - (a) Write down the 8<sup>th</sup> line of the pattern.

(b) Write down the  $n^{\text{th}}$  line of the pattern.

(c) Use the pattern to find  $340^2 - 339^2$ . [Show working – answer obtained from calculator will score no mark]

(d) Use the pattern to find the integers x and y such that  $x^2 - y^2 = 701$ [Show working – answer obtained by trial and error will score no mark]

......(1)

18. A series of diagrams of shaded and unshaded small triangles is shown below.



The shaded triangles are those which have at least one side on the edge of the big triangle. All the other small triangles are unshaded.

Consider the table below, which shows numbers of small triangles.

Diagram	1	2	3	4	5	n
Number of shaded triangles	3	6	9			 x
Total number of triangles	4	9	16	25		 у
Number of unshaded triangles	1	3	7			 Z

(a) Complete the column for Diagram 4 in the table above.

(1)

(b) By considering the number patterns in the table, complete the column for Diagram 5 in the table above.

(1)

- (c) Find, in terms of n, expressions for x, y and z.
  - *x* =.....(1)
  - *y* =.....(1)
  - *z* =.....(1)
- (d) Find the number of unshaded small triangle in Diagram 100.

19. The following circle is inscribed inside a square. Write down the ratio of the area of the shaded region to the circle as a fraction in its simplest form. (Your answer may contain  $\pi$ .)



20. Mrs Silcott travels from Harrow on the Hill to Piccadilly. She leaves Harrow on the Hill at 09:00 and arrives at Piccadilly, 12km away, at 10:45. She walked part of the way at 5km/h and ran the rest of the way at 8 km/h. By letting x equal the distance she walked, write down an equation summarising the question, and solve this to find out how far she ran. Leave your answer correct to 2 decimal places.

......(4)

## **End of Paper**



# Scholarship Examination 2022

# **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 <u>not just about getting the right answers</u>; correct answers on their own will earn few marks. You will be marked more on the <u>PRESENTATION</u> of your solutions, the <u>EXPLANATION</u> of your working and the <u>JUSTIFICATION</u> of your final answers.

- a. Joseph plays tiddlywinks. His mum calculates his mean score across a season to be 35.2 points per match. He asks her "did you remember that my match against Aaron got cancelled at the last minute because he broke his arm?". His mum says that she had forgotten so she recalculates his mean score and gets 36.8 points per match. How many matches did Joseph play in the season?
  - b. Henry plays in five cricket matches. The mean number of runs he scores across these five matches is double the mean number of runs he scored in the first three matches. Given that, in total, he scored 160 runs, find the maximum possible number of runs he could have scored in any one of his matches.
- 2. To raise money for charity, Joss is going to walk a distance equivalent to circumnavigating the globe. Estimate how long this will take him. You may assume that the radius of the earth is 6000km, and should state any further assumptions you make.
- **3.** The number n! (said "n factorial") is equal to  $1 \times 2 \times 3 \times ... \times (n-1) \times n$ . For example,  $4! = 1 \times 2 \times 3 \times 4 = 24$ .
  - a. Work out the value of:
    - i. 5!
    - ii.  $(2 \times 3)! (2! \times 3!)$
    - iii.  $41! \div 39!$  (don't try to work out 41! or 39!)
  - b. Explain why  $\frac{(n+1)!}{(n-1)!} = n^2 + n$ , regardless of the value of n.
  - c. Determine which is larger out of  $(n-1)! \times (n+1)!$  and  $(n!)^2$ .
  - d. Find a pair of numbers *m* and *n* for which  $\frac{m!}{n!} = 2022$ .
- 4. a. Solve 7(2(x+3) (2-x)) 4(2x-5) = 4(x+16)
  - b. Hence solve:

i. 
$$7(2(a^2+3) - (2-a^2)) - 4(2a^2-5) = 4(a^2+16)$$

ii.  $7(2(\sqrt{b}+3) - (2-\sqrt{b})) - 4(2\sqrt{b}-5) = 4(\sqrt{b}+16)$ 

iii. 
$$7\left(2\left(\frac{2}{c}+3\right)-\left(2-\left(\frac{2}{c}\right)\right)\right)-4\left(\frac{4}{c}-5\right)=4\left(\frac{2}{c}+16\right)$$

5. This question involves *factorial numbers*, which are defined in Q3.

We can think about the number of 0s on the end of n!. For example, 11! = 39,916,800, which has **two** 0s on the end.

- a. The last nine digits of 34! are ... 520,000,000. How many 0s do:
  - i. 33!
  - ii. 35!

have on the end?

- b. Determine, with justification, how many 0s there are on the end of 20!
- c. How many positive whole numbers *n* there for which *n*! doesn't contain any 0s? Justify your answer.
- 6. Tim likes to go on boat journeys. His boat always moves at the same speed relative to the water. Last weekend he went boating in a river which was flowing at a constant rate. He first travelled upstream (i.e. *against* the flow of water) for 3½ hours, before turning round and travelling downstream (i.e. *with* the flow of water) back to where he started. The return leg of his journey took him 2½ hours.
  - a. Find the ratio of the speed of the boat (in still water) to the speed at which the river was flowing.
  - b. Find how long it would take the boat to travel the same distance in still water.

- 7. You are given that  $145 \times 290 = 42,050$ . Using this fact, work out the following:
  - a. 14.5 × 29
  - b. 42,050 ÷ 0.29
  - c. 155 × 290
  - d. 145<sup>2</sup>
  - e.  $\sqrt{420.5 \div 50}$
  - f. Find a pair of numbers A and B for which  $\frac{435}{42050} = \frac{1}{A} + \frac{1}{B}$ .

**NB** You will earn very few marks for working these out directly – this question is about how you use the fact you are given.

8. In the diagram below, the two circles each have radius 2cm and pass through each other's centre (labelled  $O_1$  and  $O_2$  respectively). The two points where the circles intersect are labelled A and B.

Definition: A *sector* is a part of a circle created by two straight cuts from its edge to its centre (e.g. (a, b) and (a, b))



- a. What is the size of the angle labelled *x*? Justify your answer.
- b. By first working out its height, find the area of the triangle  $AO_1O_2$ . You should leave a square root in your answer.
- c. By thinking of it as a fraction of the circle with centre  $O_1$ , work out the area of the sector  $O_1AB$  (shown in the diagram below). You should use  $\pi = \frac{22}{7}$ .



d. By considering your answers to parts (b) and (c) together, find an expression (involving a square root) for the area of overlap between the two circles (shaded in the diagram above).

In the diagram below, the three circles each have radius 2cm and the centre of each circle lies is at a point of intersection of the other two circles.

e. Find an exact expression for the area of overlap between the three circles (shaded in the diagram).



**END OF PAPER** 

There are no questions printed on this page.



# Philosophy and Applied Ethics Scholarship Examination 2022

## 75 minutes

You have 30 minutes to read through reading on 'Truth in Ethics' and then 45 minutes to answer the question. Do take time to plan and draft your answer.

Use blue or black ink for text.

# Truth in Ethics

Turning and turning in the widening gyre The falcon cannot hear the falconer; Things fall apart; the centre cannot hold; Mere anarchy is loosed upon the world, The blood-dimmed tide is loosed, and everywhere The ceremony of innocence is drowned; The best lack all conviction, while the worst Are full of passionate intensity. (W. B. Yates, 'The Second Coming', 1920)

Meta-ethics takes a 'bird's-eye view' of ethics. It challenges individuals to think about the assumptions, rules and concepts that are relied on in discussions about what is right and wrong and then to subject them to serious analysis. It is concerned with the origin of moral standards, whether they are real or absolute and in what sense. It is also concerned with how language is used in discussions about right and wrong and what terms such as 'right' and 'wrong' actually mean. John Locke described the work of the philosopher as clearing away the undergrowth so that we can better see the challenges ahead; in this case meta-ethics should be the first concern of every moral philosopher.

## The View from the Cave

Plato (c. 427-347) sowed the seeds for modern meta-ethics. The Republic takes the form of a dialogue between various charac-

ters, each of whom represents a different way of thinking about an essential principle of moral discussions, justice.

- Polemarchus argues that being a just person enhances the life of the individual.
- Thrasymachus says that justice is whatever is in the best interests of the strong and the powerful. Morality is the creation of those in power, a system which is designed to keep them in power!
- Glaucon agrees that morality is a human construct, but argues that it is pragmatic, designed in order that people can live together in society.

None of these three sees justice as an absolute or 'real'; Socrates rejects their positions and maintains that justice is absolute and relates to 'the good' which exists independently of human perception. The dialogue shows Socrates' position to be the strongest.<sup>1</sup>

For Plato justice, good and truth exist, they are real in an ultimate sense. The 'Form of the Good' exists eternally, beyond the limitations of time and space, metaphysically. Dim reflections of these absolute qualities are seen in objects and actions in the physical world and encourage individuals to contemplate the

The character of Socrates in Plato's dialogues usually seems to represent Plato's own view, and we are not sure which of the views he attributes to Socrates actually stemmed from Socrates. Socrates was Plato's teacher and inspiration and it is sad that we do not have Socrates' own account of his thinking, given the extent of his influence in western philosophy. Socrates was no academic author; his approach to philosophy was intensely practical, not to say annoying! He spent his days in the forum asking awkward questions and challenging every assumption, every unfounded belief.

It was because Socrates challenged the basis of Athenian religion and morality, because he threatened to destabilize the state by 'corrupting the young' into thinking for themselves (essentially because he engaged in metaethics), that he was put on trial and given the choice between death and exile. He chose to drink hemlock: being forced to deny the truth would be worse than death. Socrates became a martyr for reason; he triumphed over pragmatic politicians with truth his standard and became a hero for all philosophers. See Plato's *Apology*.

essence of goodness, which is the origin of beauty, justice and even mathematics.

In Book Seven of *The Republic* Plato used the analogy of the cave to explain his understanding of reality. A group of prisoners are confined underground in a cave, in almost total darkness. They are chained, facing a rock wall. The captors have a fire lit behind the prisoners and sometimes move around the cave, casting shadows of their activities against the wall. The prisoners' total reality is the shadows on the wall. They cannot conceive of the world outside. Even if one of the prisoners escaped and came back to tell them about the sun and the trees and the flowers they would simply have to kill him. It would be too unsettling to have their understanding of reality challenged, let alone to accept that they are in prison.

The film *The Matrix*<sup>2</sup> explores a similar idea. Neo discovers that his world is artificial, a computer-generated reality, and is given the choice over whether he stays in the Matrix or tries to leave. *The Truman Show*<sup>3</sup> tells the story of a man who was born and has always lived in a reality TV show. His whole world is the creation of the TV company; but one day he discovers the edge of the set and escapes.

For Plato, the task of the philosopher is to escape from the world of illusion, the shadow world perpetuated by ignorant society, to try to see things as they really are.

For Plato there is little point in discussing God in relation to moral standards. Different societies worship different gods and claim divine authority for behaving in shockingly irrational and contradictory ways. However, he argues for moral standards that are independent, universal, real, and that may be known through reason.

<sup>2 1999,</sup> written and directed by Larry and Andy Wachowski.

<sup>3 1998,</sup> directed by Peter Weir.

## The Fog Descends

Sadly, during the twentieth century meta-ethics became obsessed with semantics, linguistic analysis, and came to undermine both normative and applied ethics. Law and moral norms were seen to be pragmatic at best and cultural constructions at worst. What can a moral philosopher do if the business of recommending how we should respond to practical dilemmas has been discredited? The alternatives seem to be to either retreat into technical and obscure meta-ethics or become a sociologist.

In northern England, people tend never to say that it rains; there may be gloam, drizzle or mizzle, it may be dank or dreary and it frequently pours down, but it rarely just 'rains'. Language is often colourful and can be used to mark territory, to divide 'insiders' from 'outsiders' and highlight newcomers. Philosophers need language to be precise, but sometimes the desire for clarity results in a proliferation of technical and obscure words which make it difficult for 'outsiders' to take part in or evaluate discussions.

Sadly, in a world where academic careers are measured by number of publications and citations some philosophers appear to have exploited this, coining yet more terms as an easy way of gaining status. Ironically, professional philosophy has actually 'planted undergrowth', obscuring the 'big questions' rather than exposing them.

## What Is Truth?

There are two basic theories of truth.

 Realists maintain that a statement is true or false in relation to how it corresponds to an independent state of affairs. So:

 (a) 'The cat sat on the mat' is true, if – and only if – there is a cat sitting on the mat; or (b) 'Petra is beautiful' is true, if Petra conforms to some absolute standard of beauty; or (c) 'Rape is wrong' is true, if rape is wrong according to some ultimate set of values.

 • Anti-realists maintain that a statement is true or false because it coheres with other statements and beliefs within a particular community or 'form of life'.<sup>4</sup> So 'It is wrong to tackle a person who is running' is true within a game of cricket and false within a game of rugby. 'A man may have only one wife' is true within Christian cultures and false within Islamic cultures; and the truth of statements such as 'It is good to help widows and orphans' may depend on the situation or on cultural values.

Realism and anti-realism underpin discussions in ethics as much as other philosophical discussions.

Traditionally people have accepted that claims about good, bad, right and wrong relate to real and absolute values, that the claims should correspond to truth, to the way things are objectively. During the nineteenth century, however, people began to question the existence of real values; experience of different cultures and different types of people, combined with the loosening grip of religion, suggested that values are at least culturally relative and are not absolute. What may be 'right' in one culture may be 'wrong' in another. It is not just a matter of some cultures being right and others wrong, but rather that truth actually depends on the culture we are in. What is right for one person in one set of circumstances might be wrong for another person in different circumstances. For relativists moral statements are true or false only to the extent that they cohere with what people accept: they are subjectively true.

<sup>4</sup> The term used by Wittgenstein to indicate the community or culture within which language is understood, develops and operates.

## **Question:**

'It is difficult to decide what is right and wrong'.

Evaluate this view.

In your answer you should:

- make references to the text above;
- give reasoned arguments to support this statement;
- give reasoned arguments to support a different point of view; and
- reach a justified conclusion.



## **Science Scholarship Examination 2022**

## 2 Hours

Section A 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 Sheet provided.

Sections B, C and D are to be answered on the examination paper in the spaces provided.

Use blue or black ink for text.

You may use a pencil and a ruler for diagrams.

You may use a calculator

## 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. The disease scurvy is caused by a lack of which nutrient in the diet?
- A. calcium
- B. protein
- C. vitamin C
- D. vitamin D
  - 2. Which of the following organisms is not a producer?
- A. mushroom
- B. seaweed
- C. cactus
- D. moss
  - 3. What is the correct order of organs in the human digestive system from mouth to anus?
- A. oesophagus  $\rightarrow$  stomach $\rightarrow$  small intestine  $\rightarrow$  large intestine
- B. stomach  $\rightarrow$  oesophagus  $\rightarrow$  large intestine  $\rightarrow$  small intestine
- C. oesophagus  $\rightarrow$  stomach  $\rightarrow$  large intestine  $\rightarrow$  small intestine
- D. stomach  $\rightarrow$  oesophagus  $\rightarrow$  small intestine  $\rightarrow$  large intestine
  - 4. What, approximately, is the surface area of an adult elephant?
- A. 2 m<sup>2</sup>
- B. 20 m<sup>2</sup>
- C. 200 m<sup>2</sup>
- $D. 2000 m^2$



- 5. Which is the most ancient group of vertebrates?
- A. amphibians
- B. reptiles
- C. mammals
- D. fish
  - 6. Who is this famous biologist?
- A. Louis Pasteur
- B. Alexander Fleming
- C. Richard Dawkins
- D. Charles Darwin



- 7. The drawing is of a mitochondrion observed down a microscope. The actual length of the mitochondrion is 6  $\mu$ m. What is the magnification of the drawing? (1  $\mu$ m = 0.001 mm.)
- A. 10x
- B. 100x
- C. 1000x
- D. 10 000x



- 8. Yeast cells reproduce asexually by a process called budding where a new cell grows from an existing cell and then separates to become a new independent cell. In optimum conditions, a yeast cell can produce a bud every 90 minutes. Starting with 1 yeast cell, how many yeast cells would there be at the end of 24 hours in optimum conditions.
- A. 1
- B. 17
- C. 65 536
- D. 16 777 216



- **9.** The apparatus was used to investigate the effect of light intensity on the rate of photosynthesis. What gas is given off by the pondweed?
- A. oxygen
- B. carbon dioxide
- C. nitrogen
- D. methane



## **10.** Which graph shows the effect of temperature on the rate of diffusion?



#### Questions 11-12

Small pieces of four metals, copper, magnesium, nickel and zinc, were placed in test tubes containing small quantities of hydrochloric acid, HCl<sub>(aq)</sub>. The following results were observed.



**11.** Use the observations to complete the order of these metals in decreasing order of reactivity.

- A. copper, nickel, zinc, magnesium
- B. magnesium, zinc, nickel, copper
- C. magnesium, nickel, zinc, copper
- D. copper, zinc, nickel, magnesium

**12.** The gas was collected and its identity proven using a chemical test. The gas was found to:

- A. relight a glowing splint
- B. burn with a squeaky pop
- C. turn limewater cloudy
- D. turn cobalt chloride paper pink

**13.** The diagram shows the heating curve for water. Identify the correct labels for each section.



	V	W	Х	Y	Z
Α	solid	liquid	evaporation	melting	gas
В	solid	melting	boiling	liquid	gas
С	condensing	solid	liquid	melting	gas
D	heating	solid	condensing	liquid	gas

#### Questions 14-16

Potassium manganate (KMnO<sub>4</sub>) is a bright purple substance that dissolves in water.

- 14. Potassium manganate is behaving as the
- A. solute
- B. solvent
- C. reactant
- D. product

**15.** Select which words would be appropriate to describe this process.

- A. Diffusion, Dilution, Melting
- B. Dilution, Melting, Mixing
- C. Mixing, Melting, Diffusion
- D. Diffusion, Mixing, Dilution
- **16.** This process would proceed more slowly with:
- A. warmer water & stirring
- B. same temperature with stirring
- C. same temperature with decreased pressure
- D. colder water



**17.** A bag of NPK fertiliser contains 20% nitrogen (N) and 8% phosphorous (P). What is the proportion of each component?

	nitrogen (N)		phosphorous (P)	potassium (K)
Α	10	:	4 :	8
В	20	:	8 :	82
С	10	:	4 :	18
D	5	:	2 :	18

**18.** Limestone is added to fields to:

- A. act as a fertiliser to the soil
- B. neutralise the effects of acid rain on the soil
- C. improve calcium content of potatoes
- D. improve the efficiency of the water cycle

#### Questions 19-20

One reaction used in the manufacture of nitric acid is shown here as a chemical equation.

 $4 \text{ NO}_2 + \text{O}_2 + 2 \text{ H}_2\text{O} \rightarrow \underline{x} \text{ HNO}_3$ 

- **19.** Complete this equation by indicating the number of nitric acid (HNO<sub>3</sub>) molecules (x) produced from the proportion of reactants shown.
- A. 1
- B. 2
- C. 4
- D. 6

**20.** What is the name of the first reagent in the equation, NO<sub>2</sub>?

- A. nitrogen dioxide
- B. nitrogen trioxide
- C. nitrous oxide
- D. nitrogen oxide

A tennis player hits a ball hard and 0.40s later hears the echo from a wall.



### 22.

A student uses a ruler to measure the length and the width of a small rectangular metal plate.



What is the area of the plate?

A 14.0cm<sup>2</sup> B 14.7cm<sup>2</sup> C 16.0cm<sup>2</sup> D 16.8cm<sup>2</sup>

#### 23.

Which instrument is used to compare the masses of objects?

- A. a balance
- B. a barometer
- C. a manometer
- D. a measuring cylinder

#### 24.

In a hydroelectric power station, one form of energy is stored in a lake or reservoir. This energy is then transferred in stages to another useful form, which is the output.

Which row gives the name of the stored energy and the name of the output energy?

	stored energy	output energy
A	electrical	thermal (heat)
в	electrical	kinetic
С	gravitational	electrical
D	kinetic	electrical

#### 25.

A car travels along a horizontal road at a constant speed. Three horizontal forces act on the car. The diagram shows two of these three forces.



What is the size and the direction of the third horizontal force acting on the car?

- A 1200N backwards
- B 1200 N forwards
- C 1800N backwards
- D 1800 Nforwards

The diagrams show three uniform beams P, Q and R, each pivoted at its centre.

The two forces acting on each beam are also shown.



Which beams rotate clockwise?

- A. P and Q only
- B. P and R only
- C. Q and R only
- D. P, Q and R

27.

A negatively charged plastic rod P is placed above a positively charged plastic rod Q.



What are the directions of the electrostatic forces on rod P and on rod Q?

	electrostatic force on rod P	electrostatic force on rod Q
Α	downwards	downwards
В	downwards	upwards
С	upwards	downwards
D	upwards	upwards

26.
The diagram shows a torch containing two cells, a switch and a lamp.



Which is the circuit diagram for the torch?



29.

Four nails, A, B, C and D, are tested to find which makes the strongest permanent magnet.



One of the nails is placed against a bar magnet and the number of paper clips which the nail can support is recorded. The bar magnet is then removed and the number of paper clips remaining attached to the nail is recorded. Each nail is tested in turn.

Which nail becomes the strongest permanent magnet?

nail	number of paper clips attached to the nail		
	bar magnet present	bar magnet removed	
A	2	0	
В	2	1	
С	4	3	
D	5	2	

28.

30.

The word WE, as shown below, is viewed in a mirror.



What does its reflection look like in the mirror?

A B B C M E W B J D D

**End of Section A** 

Section A Total = 30 marks

# HARROW SCHOOL 13+ SCHOLARSHIP SCIENCE EXAMINATION 2022 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



# Demand for electric car parts may seal fate of budding primrose

The Daily Telegraph · 7Jan 2022 · By Olivia Rudgard ENVIRONMENT CORRESPONDENT





Example of malachite ore mined from the earth

Streptocarpus malachiticola, found in DRC could fall prey to alltime high global copper prices A NEW primrose species discovered only last year is under threat from mining for electric car parts, Kew Gardens scientists have warned. A variety of Cape primrose found in Katanga in

'The plant is found on the Congo's malachite seams, from which copper can be used in electrical wiring'

the DRC (*Democratic Republic of the Congo*) grows on copper ores and may fall victim to growing demand for the metal as electric car sales rise.

The plant's name, *Streptocarpus malachiticola,* means "growing on malachite" because it isfound on

the Congo's rich malachite seams, from which copper can be extracted for use in electrical wiring.

Global copper prices are at an all-time high because of growing demand for parts with one electric car requiring up to 176 lbs of copper to build.

The species, found in just three locations, is categorised as endangered by the International Union for Conservation of Nature because of the threat, Kew scientists said. Plants officially new to science last year also include a rare tooth fungus found in Windsor Great Park, so named because ithas "teeth" rather than gills beneath its caps.

The main component of malachite is copper carbonate which is responsible for the blue-green colour.

Copper carbonate breaks down when heated strongly.

**1.** Complete the word equation for the reaction that takes place.





**3.** State two observations you would expect to see when using the apparatus shown.

[2]

**4.** Explain whether you would expect the product of the reaction, CuO, to react with hydrochloric acid or sodium hydroxide.

**5.** The same chemical, CuO, can react with carbon.

 $2 \text{ CuO}_{(s)} + \text{ C}_{(s)} \rightarrow 2 \text{ Cu}_{(s)} + \text{ CO}_{2(g)} \qquad \text{Equation } 2$ 

Why is carbon able to react with CuO in this way?

[1]

[2]

6. Copper is used in electric cars because it is malleable & ductile.

a. Explain the meaning of either property and why this makes it suitable for use in electric cars.

b. State another property of copper that makes it ideal for its use in electric cars.

[1]

- **7.** A company carried out the reaction above shown in *Equation 2*. It was found that 159 tonnes of CuO reacted with 12 tonnes of carbon to make 127 tonnes of copper.
- a) i. What mass of waste carbon dioxide would have been made?

ii. Why is carbon dioxide considered to be a pollutant?

[1]

[1]

- **8.** The newspaper article reports 176 lbs of copper is needed to build an electric car.
- a) Convert this mass to kg. One kilogram is equivalent to 2.20462 lbs. Express the answer using 2 significant figures.
- b) Companies use percentage yield to compare the *actual* amount of product made to the *calculated theoretical maximum* amount. This indicates how efficient the process is.
   A reaction was found to have a 70% yield. What is the maximum mass <u>actually</u> produced if the calculated maximum is 102kg.

[1]

[2]

Section B Total = 15 marks

#### SECTION C: Biology Experimental Design

A student wanted to find out how much dead plant material there is in soil from different habitats (woodland, grass lawn and sandy beach).

He decided to use a random method to select where he took the samples from in each habitat. He thought that this was a better method than simply looking and choosing where to dig. He collected 5 soil samples from each habitat.

1.	Suggest a random method he could use to collect the soil samples.	(2)
•••••		
_		
2.	Do you think he was right to use a random method? Explain your answer.	(1)
3.	State two variables that should be controlled when taking a soil sample.	(2)

The soil samples were dried in an oven and then burned using the apparatus shown in the diagram overleaf:

4. Give the names of the different pieces of apparatus used.

Letter	Name of apparatus
Α	crucible
В	
С	
D	



(3)

5. Suggest how he could make sure the samples were completely dry before he burned them. (2)

The student calculated the percentage of dead plant material in each soil sample using the following formula:

percentage of dead plant material = <u>mass of dry soil – mass of burned soil</u> x 100 mass of dry soil

6. Much of the dead plant material is made up of compounds containing carbon and hydrogen.
 Explain what happens to these compounds when the soil sample is burned AND why the mass of the soil sample decreases.
 (3)

.....

 Calculate the percentage of dead plant material in a sample that weighed 10.2 g when dry and 9.6 g after being burned. Show your working.
 (2)

Answer = ..... %

Soil sample	Percentage of dead plant material in dry soil in each habitat		
_	Woodland	Grass lawn	Sandy beach
1	5.9	3.4	0.4
2	6.6	3.6	0.2
3	5.8	4.1	0.6
4	5.9	3.2	2.4
5	6.0	4.0	0.2

The results obtained by the student are recorded in the table below.

- One of the results does not fit with the others it is an anomaly. Draw a ring around this result in the table.
   (1)
- 9. The student thinks that this result might have been caused by him not drying the soil sample completely before burning it. Do you agree? Explain your answer. (2)
  10. State what type of graph or chart should be used to display the results. (1)

**11.** Suggest why soil from the woodland had the highest percentage of dead plant material. **(1)** 

.....

.....

Section C Total = 20 marks

# SECTION D: Physics Experiment and Data Analysis

On their way home from school, a group of students walk past a vehicle garage and spot a car raised up, ready to be inspected.



Image credit: https://readcars.co/2017/11/07/fix-garage-working-cars/

They know that cars are heavy and wonder how one could be lifted so high. After some online research they discover this has something to do with 'hydraulics', which they decide to investigate in an experiment.

At school, they find seven 'U'-shaped tubes, one of which is illustrated to the right. The students fill these tubes with oil, then cut circular pieces of wood with just the correct diameter to sit on top of the oil at the two ends. They imagine pushing down on the left-hand piece of wood (using a force  $F_1$ ) and observing what happens on the right-hand side. The picture to the right illustrates one of these tubes, where a toy car has been put on top of the wood block to play the role of the car in the garage.



Image credit: https://www.miniphysics.com/ss-hydraulic-systems.html

A

Both the left-hand side, and right-hand side of these tubes is shaped like a cylinder and the 'cross-sectional area' of a cylinder, A, is the area of the shaded circle as illustrated in the diagram to the left. All seven tubes have the same size of opening on the left-hand side (they all have the same cross-sectional area  $A_1$ ), but different sizes of opening on the right-hand side (they each have a different value for the cross-sectional area  $A_2$ ).

The students decide to use the same force,  $F_1$ , on each tube, and measure the force  $F_2$  that results by seeing what the tube can lift on the right-hand side.

Based on the above information, answer the following questions.

# **Questions:**

1.	What is the independent variable for the students' investigation (the variable that the students change)?		
	(1)		
2.	What is the dependent variable (the variable that changes as a result)? (1)		
3.	A control variable is a variable which must be kept constant because it <i>could</i> otherwise affect the dependent variable and invalidate the experiment; that is to say, it would not be a fair test. The area $A_1$ is an example of a control variable. Name another control variable for this experiment. (1)		
4.	What do you predict the outcome of the investigation would be? (1)		
5	The students use two 100 g masses on top of one another to produce the force E. They know		

5. The students use two 100 g masses on top of one another to produce the force F<sub>1</sub>. They know that the force produced by a mass is due to its *weight* which can be calculated using the formula

Weight in newtons = (mass in kg) x (gravitational field strength in newtons/kg)

where the gravitational field strength of the Earth is 10 newtons/kg. Calculate the force  $F_1$  in newtons. Show your working clearly.

(2)

6. Suggest how the students could determine the force  $F_2$ .

**7.** To determine the cross-sectional areas, the students use callipers to measure the internal diameters of the tubes. The measurement used to determine A<sub>1</sub> is shown below.



Image credit: <u>https://technologystudent.com/images3/vernier3.gif</u>

Using the formula for the area of a circle

 $A = \pi x radius^2$ 

determine the area  $A_1$ . Show your working clearly and include units with your answer.

(3)

(2)

The students proceed with their experiment, repeating each reading twice. Their table of results is shown below.

	F <sub>2</sub> /newtons		
$A_2$ /cm <sup>2</sup>	Measurement 1	Measurement 2	Average
0.2	1.2	0.9	1.1
0.4	2.1	2.1	2.1
0.9	4.7	4.3	4.5
1.6	8.2	12.2	10.2
2.5	12.4	12.7	
3.6	18.5	18.0	18.3
4.4	23.2	23.3	23.3

# 8. Complete the table.

9. Plot a graph of the average value of F<sub>2</sub> on the (vertical) y-axis vs. A<sub>2</sub> on the (horizontal) x-axis on the graph paper over the page. Use the graph paper as fully as you can and label your graph carefully.
(4)
10. The students notice one point which doesn't seem to follow the trend. This is called an *anomaly*. Which point is it?
(1)
11. How do you think this anomaly might have come about?
(1)
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**13.** Add a line of best fit to your graph to show the trend of the data.

(1)

(1)

P.T.O. for graph paper



P.T.O for end of question

**14.** Describe the trend suggested by your graph.

**15.** In a Physics textbook the students read that hydraulics like this work due to Pascal's law. The textbook indicates that, in this situation, Pascal's law leads to the equation

$$\frac{F_2}{A_2} = \frac{F_1}{A_1}$$

One of the students rearranges the equation to give

$$F_2 = \frac{F_1}{A_1} A_2$$

and realises that  $F_1/A_1$  should be the gradient, or slope, of a graph of  $F_2$  vs.  $A_2$ . To what extent do your results support, or contradict, this statement? Use your graph to help you and explain your reasoning. You may find it helpful to perform one or more calculations as part of your answer.

(3)

Section D Total = 25 marks