General Certificate of Education
January 2008
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

GENERAL STUDIES (SPECIFICATION A) **GSA2**
Unit 2 Science, Mathematics and Technology

Monday 14 January 2008 9.00 am to 10.15 am

For this paper you must have:
- an objective test answer sheet
- a Data Booklet for Questions 1 to 25 (enclosed)
- a black ball-point pen.

You may use a calculator.

Time allowed: 1 hour 15 minutes

Instructions
- Use a black ball-point pen.
- Answer **all** questions.
- Answer **both** Section 1 (Questions 1 to 25) **and** Section 2 (Questions 26 to 50) using the answer sheet provided.
- For each question there are several alternative responses. When you have selected the response which you think is the best answer to a question, mark this response on your answer sheet.
- Mark all responses as instructed on your answer sheet. If you wish to change your answer to a question, follow the instructions on your answer sheet.
- Do all rough work in your answer book, **not** on your answer sheet.

Information
- The maximum mark for this paper is 50.
- This paper consists of two sections.
  Section 1 contains 25 objective test questions based on material provided in a separate data booklet.
  Section 2 contains 25 objective test questions testing mathematical reasoning and its application.
- Each question carries 1 mark. You will not lose marks for wrong answers.
- 2mm graph paper is available from the Invigilator.

SECTION 1

Read the passage entitled **What's in an ice cream?** which is printed in the separate data booklet and answer **Questions 1** to **25** by choosing the answer represented by the letter **A**, **B**, **C** or **D** that you think best.

1 The average consumption of ice cream in the USA is higher than in the UK. The number of times higher is approximately

A 3.5
B 4.0
C 4.5
D 5.0

2 The timeline in **Figure 1** represents approximately

A 1300 years.
B 1900 years.
C 2000 years.
D 4000 years.

3 An aqueous solution is a solution in which

A the problems of making ice cream are solved.
B ice crystals will always form.
C water is the dissolving medium or solvent.
D gas will always be created.

4 The diameter of the labelled fat droplets compared with the diameter of a typical air bubble (**Figure 2**) is approximately

A 10 : 1
B 1 : 1
C 1 : 10
D 1 : 100

5 How much water would you expect to find in 250 g of melted ice cream?

A 130 g
B 140 g
C 150 g
D 160 g

6 An ion is an atom which has

1 lost electrons.
2 lost protons.
3 gained electrons.
4 gained protons.

Answer

A if **1** alone is correct.
B if **1** is correct and **3** is correct.
C if **2** is correct and **4** is correct.
D if all are correct.

7 The temperature at which water freezes is affected by the presence of

1 dissolved molecules.
2 ions.
3 salt.

Answer

A if **1** and **2** only are correct.
B if **1** and **3** only are correct.
C if **2** and **3** only are correct.
D if all are correct.

8 Each of the following could be described as a 'solute' (paragraph 5) **except**

A ice.
B protein.
C sucrose.
D fructose.

9 According to paragraph 5, knowledge of an ice cream's sugar content will allow a reasonable prediction of the

A flavour of an ice cream.
B ice content of an ice cream.
C molecular mass of an ice cream.
D number of proteins in the ice cream.

10 How many elements are present in sucrose (**Figure 3**)?

A 3
B 11
C 19
D 36

11 The percentage of ice, referred to in **Box 1**, increases most rapidly as the temperature is lowered from

A -15 °C to -20 °C
B -10 °C to -15 °C
C -5 °C to -10 °C
D 0 °C to -5 °C

12 At -18 °C the amount of water in the solution referred to in **Box 1** that remains unfrozen is approximately

A 20%
B 40%
C 60%
D 80%

13 Each of the following is a true statement about the freezing of a sucrose solution, as described in **Box 1**, **except**

A the amount of water frozen increases quickly at first and then more slowly as the temperature falls.
B as the water freezes the remaining solution becomes more dilute.
C even at a temperature of -25 °C there is still some liquid water.
D at a temperature of -10 °C approximately two-thirds of the water has frozen.

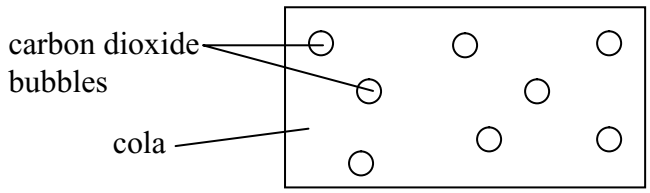
14 If a person had two ice creams at the same temperature one could feel colder than the other as they are eaten. This is caused by the

A person's imagination.
B ice cream's sugar content.
C ice cream's flavour.
D person's eating style.

15 The level part of the graph in **Box 2** indicates that

A the heat was turned down.
B all the ice has melted.
C the heat is breaking bonds.
D the temperature cannot go any higher.

16 Refer to **Box 3**.



The diagram above is an example of

A an emulsion.
B a sol.
C an aerosol.
D a foam.

17 The main ingredients in a salad dressing are oil and vinegar. Which of the following correctly describes this salad dressing (paragraph 7 and **Box 3**)?

A an emulsion
B a sol
C an aerosol
D a foam

18 According to **Box 3**, each of the following can be described as a colloid **except**

A a gas dispersed in a gas.
B a liquid dispersed in a liquid.
C a solid dispersed in a solid.
D a gas dispersed in a solid.

19 In a given volume, which would have the largest area of air-water interface?

A a few large bubbles
B a few small bubbles
C a lot of large bubbles
D a lot of small bubbles

20 A protein, beta-casein, is particularly good at sticking across interfaces between phases of substances in ice cream. Which of the following is/are correct?

1 The heads are non-polar and are able to interact with the air phase.
2 The tails are polar and are able to interact with the water phase.
3 The heads are polar, mix well with water and protect the bubbles.
4 The tails are non-polar and are able to interact with the water phase.

Answer

A if **3** alone is correct.
B if **1** and **2** only are correct.
C if **1** and **4** only are correct.
D if **1**, **2** and **4** only are correct.

21 Which of the following statements is/are true?

1 Ice cream is a 20th century invention.
2 Electricity is needed to make ice cream.
3 Milk helps keep the air bubbles stable.

Answer

A if **3** alone is true.
B if **1** and **2** only are true.
C if **2** and **3** only are true.
D if all are true.

22 Which of the following statements are facts rather than opinions?

1 There are new and exciting products to be developed as ice cream knowledge advances.
2 There is a greater consumption of ice cream per person in the USA compared with the UK.
3 Increasing the amount of air in ice cream gives it its white colour.

Answer

A if **1** and **2** only are facts.
B if **1** and **3** only are facts.
C if **2** and **3** only are facts.
D if all are facts.

Assertion / Reason questions

For **Questions 23** to **25** you are given an assertion followed by a reason. Consider the assertion and decide whether, on its own, it is a true statement. If it is, consider the reason and decide if it is a true statement. If you decide that **both** the assertion **and** the reason are true, consider whether the reason is a valid or true explanation of the assertion. Choose your answer **A**, **B**, **C** or **D**.

	Assertion	Reason	Argument
A	True	True	Reason is **a correct** explanation of assertion
B	True	True	Reason is **not a correct** explanation of assertion
C	True	False	Not applicable
D	False	–	Not applicable

	ASSERTION		REASON
23	Adding proteins to ice cream allows the air bubbles to be stabilised	because	the protein molecule used has one part which is polar and another which is non-polar.
24	When freezing the sucrose solution referred to in **Box 1**, once some ice has formed the remaining liquid has to be colder to freeze	because	the remaining liquid is a more concentrated solution.
25	The water in ice cream does not freeze at 0 °C	because	ice cream contains a large number of protein molecules compared to sugar molecules.

END OF SECTION 1

Turn over for SECTION 2

SECTION 2

Answer **Questions 26** to **50.**

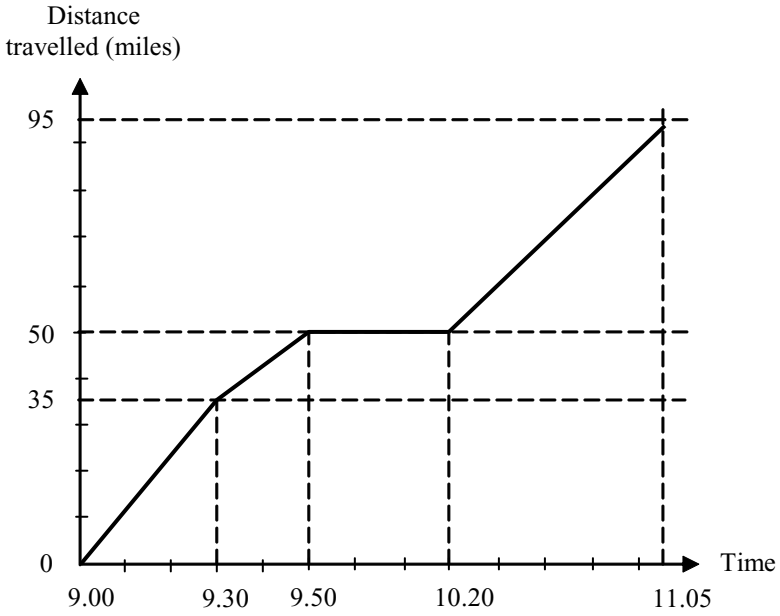
For each of **Questions 26** to **50** choose the answer represented by the letter **A**, **B**, **C** or **D** that you think best. Graph paper is available from the Invigilator.

26 On average, a baby is born somewhere in the world every second.

The number of days it takes for one million babies to be born is approximately

A 1
B 12
C 86
D 700

27 The distance time graph for a car journey is shown below.



At which of the following times was the car travelling fastest?

A 9.15
B 9.45
C 10.15
D 10.45

28 At a café Tom bought 5 teas and 2 coffees, which cost a total of £8.

Dick bought 2 teas and 4 coffees, which also cost a total of £8.

The cost of a coffee was

A £1
B £1.20
C £1.23
D £1.50

29 A heavy construction vehicle travels for 40 minutes between sites, at an average speed of 16 metres per second. The distance between sites is

A 2.5 km
B 6.4 km
C 10.7 km
D 38.4 km

30 Which of the following rearrangements of $s = \frac{n}{2}(p + q)$ are correct?

1 $2s - np = nq$

2 $2s - n = p + q$

3 $\frac{2s}{np} = nq$

4 $\frac{2s}{n} = p + q$

Answer

A if **1** and **2** only are correct.
B if **1** and **4** only are correct.
C if **2** and **3** only are correct.
D if **3** and **4** only are correct.

Questions 31 and 32

In a board game, 98 tiles have a letter of the alphabet on them. There are also two blank tiles.

Of these 100 tiles, the letter E is on twelve, G is on three and C is on two of them.

31 A tile is selected at random. The probability that it is an E is

A $\frac{1}{26}$

B $\frac{3}{25}$

C $\frac{3}{22}$

D $\frac{7}{50}$

32 A player takes out three tiles at random, one after the other.

The probability that the tiles are G, C and E, in that order, is given by the calculation

A $\frac{3}{100} \times \frac{2}{100} \times \frac{12}{100}$

B $\frac{3}{100} + \frac{2}{100} + \frac{12}{100}$

C $\frac{3}{100} \times \frac{2}{99} \times \frac{12}{98}$

D $\frac{3}{100} + \frac{2}{99} + \frac{12}{98}$

33 If p and q are positive integers, and $3p + 7q = 16$, how many different values can p take?

A 1
B 2
C 3
D 4

34 The numbers 5.8×10^8, 1.2×10^{-5}, 3.6×10^4, 2.2×10^8 when arranged in increasing order of size are

A 5.8×10^8, 2.2×10^8, 3.6×10^4, 1.2×10^{-5}
B 1.2×10^{-5}, 2.2×10^8, 3.6×10^4, 5.8×10^8
C 3.6×10^4, 1.2×10^{-5}, 2.2×10^8, 5.8×10^8
D 1.2×10^{-5}, 3.6×10^4, 2.2×10^8, 5.8×10^8

Questions 35 and 36

The table below shows the number of public holidays a year in a sample of 58 countries.

Number of public holidays	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Frequency	1	1	0	1	2	7	3	7	9	11	5	3	3	3	1	1

35 The modal number of public holidays a year for these countries is

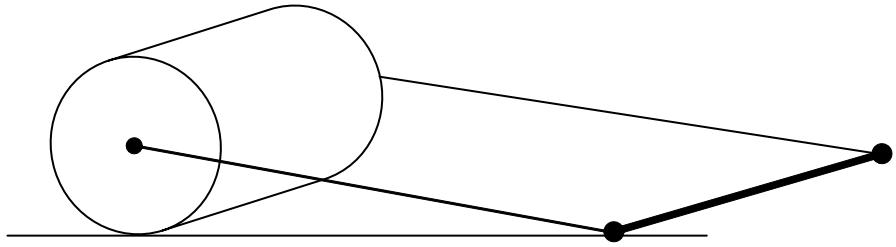
A 1
B 11
C 12
D 18

36 Another country with 18 public holidays a year is added to the list. Which of these statistical measures will change?

A mean
B median
C mode
D mean, median and mode

Questions 37 to 40

A cylindrical garden roller has a width of 80 cm and a diameter of 60 cm. It stands on level ground with its handle, which is 90 cm long, resting on the ground.



not to scale

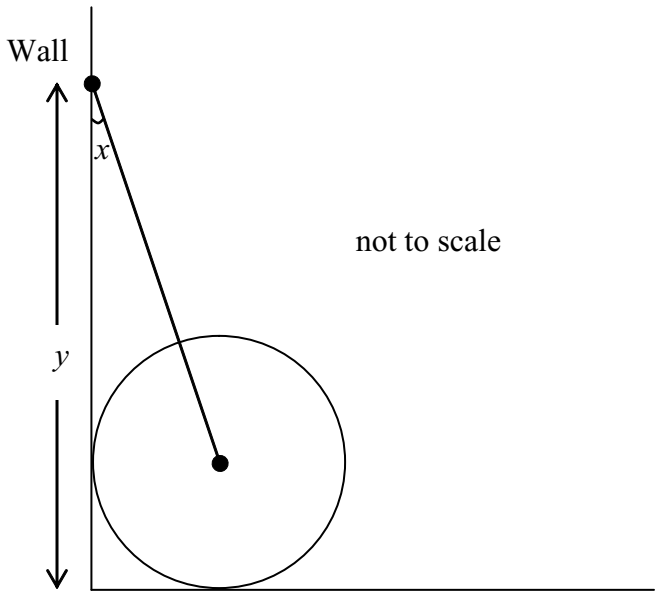
37 The roller cylinder is hollow, and is filled with water. What volume of water, to the nearest 5 000 cm^3, can the roller hold?

A 15 000 cm^3
B 30 000 cm^3
C 225 000 cm^3
D 905 000 cm^3

38 When the roller is used, how far, to the nearest 0.1 m, does it have to travel for the roller to complete one revolution?

A 1.9 m
B 2.5 m
C 2.9 m
D 3.8 m

39 The diagram below shows a side view of the roller against a wall.



What is the height (marked *y* in the diagram) of the top of the handle above the ground?

A 104 cm
B 115 cm
C 120 cm
D 125 cm

40 What angle (marked *x* in the diagram) does the handle make with the wall?

A 18°
B 19°
C 34°
D 42°

Turn over for the next question

Questions 41 and 42

A Premiership football club has 42 000 season tickets for sale.

It sells two-thirds of them at £500 each, a quarter of them at £750 each, and the rest at £900 each.

41 Which of the following statements are correct?

1 The income from the £500 tickets is more than twice the income from the £750 tickets.
2 The income from the £750 tickets is two-and-a-half times the income from the £900 tickets.
3 The income from the £900 tickets is less than a quarter of the income from the £500 tickets.

Answer

A if **1** and **2** only are correct.
B if **1** and **3** only are correct.
C if **2** and **3** only are correct.
D if all are correct.

42 The mean price of a season ticket is between

A £500 and £600.
B £600 and £700.
C £700 and £800.
D £800 and £900.

43 A rectangular frame has adjustable sides. The length of the rectangle is always three times the width. The area can vary between 12 square inches and 48 square inches. If the width is x inches, which one of the statements which follow must be true?

A $2 \leq x \leq 3$
B $2 \leq x \leq 4$
C $3 \leq x \leq 4$
D $4 \leq x \leq 6$

44 Melissa estimates that each year the value of her lawnmower will decrease by 10%. Its present value is £270. What is the estimated value of the lawnmower in two years' time?

A £215
B £220
C £245
D £250

Questions 45 and 46

Body Mass Index (BMI) is a measure of the relationship between a person's height and weight; a BMI of more than 25 is considered unhealthy.

A person's BMI is calculated by dividing their weight, in kilograms, by the square of their height, in metres.

45 An overweight man halves his weight. What is the effect on his BMI?

A It is reduced by 25%.
B It is reduced by 50%.
C It is reduced by 75%.
D It is impossible to tell without knowing his height.

46 A woman is 170 centimetres tall and wants to achieve a BMI of 25. The weight she should aim for is

A 46 kg
B 68 kg
C 72 kg
D 85 kg

47 $x = -2$ is a solution of the equation $(x - 1)(x + 5) = k$. The value of k is

A -9
B -1
C 1
D 9

48 If $0 < p < q < 1$, which of the following **must** be greater than 1?

A $q - p$

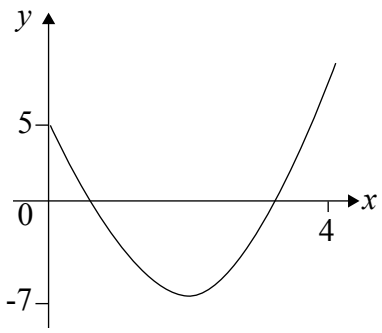
B pq

C $\frac{p}{q}$

D $\frac{q}{p}$

Questions 49 and 50

The graph of $y = x^3 - 2x^2 - 6x + 5$, for $x \geq 0$, is shown opposite.



49 If y is also defined for negative values of x, what is the value of y when $x = -2$?

A -23
B -7
C 1
D 17

50 With reference to the graph above, the number of positive solutions the equation $x^3 - 2x^2 - 6x + 1 = 0$ has is

A 0
B 1
C 2
D not possible to determine.

END OF QUESTIONS