GENERAL KNOWLEDGE AND LOGICAL REASONING

1.Oakley is west of Carson, which is west of Newton. Earith is east of Carson and west of Wembourne.
Wembourne must be east of:
A Carson, but not necessarily east of Oakley or Newton;
B Newton, but not necessarily east of Carson or Oakley;
C Carson and Oakley, but not necessarily east of Newton;
D Oakley and Newton, but not necessarily east of Carson;
E Carson, Oakley and Newton.

2.Every branchiopod is a crustacean and every crustacean is an arthropod. No insect is a crustacean. Which **two** of the following must be true?
A Every branchiopod is an arthropod.
B No insect is an arthropod.
C No branchiopod is an insect.
D Some crustaceans are insects.
E Some insects are crustaceans

3.A government study suggested that courses in adult education should be subsidised because they contribute to the economy, raise skills and improve job opportunities. However where an adult education course is purely for leisure there is no case for subsidy. Therefore subsidies for courses which are purely for leisure should be abandoned.
Which **one** of the following is an underlying assumption of the above argument?
A Unemployment figures are showing an upward trend.
B Large numbers of adults will attend these courses.
C There are enough teachers for the courses which would be subsidised.
D Adults attending these courses will be able to upgrade their jobs if they pass the examinations.
E Courses which are purely for leisure cannot be economically useful.

4.If someone is suffering from influenza, they may have a sore throat or blocked nasal passages. Some, but not all, influenza sufferers with a sore throat also have blocked nasal passages. Some, but not all, influenza sufferers with blocked nasal passages also have a sore throat.
Which **one** of the options, **A** to **F**, correctly lists the following statements in order of their probabilities, giving the least likely first?
1 Someone suffering from influenza will have a sore throat.
2 Someone suffering from influenza will have a sore throat and blocked nasal passages.
3 Someone suffering from influenza will have a sore throat or blocked nasal passages.
A 1, 2, 3
B 1, 3, 2
C 2, 1, 3
D 2, 3, 1
E 3, 1, 2

5.Two buses, the Zipper and the Metbus, each pass my stop hourly, and I can catch either one. I have no regular times for travelling and I can never remember the bus times. I just

go to the stop and catch the first bus that comes along. Yet I discover, over the year, the Zipper is more likely to come along first than the Metbus.

The Zipper passes the stop at **z** minutes past every hour and the Metbus passes at **m** minutes past. If the Zipper passes the stop in the first half of the hour, which **one** of the following would explain the higher probability of the Zipper coming along first?

A $z > m$

B $m > 30$

C $z/m < 1$

D $0 < (m-z) < 30$

E $0 < (m-z) < 60$

6.In order to succeed in academic examinations it is necessary to study hard. Therefore if a student studies hard in a particular subject, that student should succeed in examinations in that subject.

Which **one** of the following is the best statement of the flaw in the above argument?

A It assumes that students must study hard in order to succeed.

B It overestimates the value of studying in preparation for examinations.

C It ignores the fact that some examinations are more difficult than others.

D It assumes that studying hard is a sufficient condition for academic success.

E It ignores the fact that some students do not need to study hard in order to succeed

7.The 400 seats in a parliament are divided amongst five political parties. No two parties have the same number of seats, and each has at least 20.

What is the largest number of seats that the third largest party can have?

A 22

B 118

C 119

D 120

E 121

8.Over the past 100 years there has been a rise in global average temperatures of 0.5°C. Because of this phenomenon of 'global warming' all coastal defences built in the future to protect Britain's most vulnerable regions from flooding should be of a different design to those currently employed, in order to allow for an annual increase in the sea level.

Which of the following are underlying assumptions of the above argument?

1 Global warming is likely to cause a rise in sea levels.

2 The trend of global warming is likely to continue.

3 Current coastal defences are likely to prove ineffective against rising sea levels.

A 1 only

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

E 1, 2 and 3

9.Methods of financing health services in advanced industrial countries have little effect, statistically speaking, on the health of the population. There are countries which spend six times as much per head on health care as Britain, and countries which spend only half as much: their populations end up with more or less the same life expectancy. Therefore arguments about levels of financing Britain's National Health Service are largely irrelevant to the health of the population.

Which **one** of the following is an underlying assumption of the above argument?

A The cost of Britain's health service is disproportionate to its effectiveness.
B Spending is the most effective way of improving a health service.
C Advanced industrial countries have failed to improve the health of their inhabitants.
D Governments have a responsibility to organise efficient health care services.
E Life expectancy is a reliable measure of the health of the population.

10.Jay always shops at Goodstuff. Kay shops at Goodstuff on weekdays but at weekends she shops at Stockup. Lee always shops at Stockup for food but at Fresco for all other goods.
One of the three sees the other pair of shoppers coming out of one of the shops where they have both been buying food.
Which **one** of the following **cannot** be true?
A It's a weekday.
B It's a weekend and the shop is Stockup.
C The shop is Goodstuff and one of the pair of shoppers is Kay.
D It's a weekend and the shop is Goodstuff.
E It's a weekend and neither of the pair of shoppers is Jay.

11. Over a period of time, a doctor has appointments with 2400 different patients. 40% of the patients are male, and 70% of the female patients are 50 years of age or over. On average, 1 in 20 of all patients cancels an appointment. Assuming all patients are equally likely to cancel their appointments, what is the most likely number of female patients less than 50 years old who cancel? (To the nearest whole number.)
A 18
B 20
C 22
D 42
E 44

12. I wish to repaint the walls of my garage. It is 3 metres high, 4 metres wide and 9 metres deep. I shall not need to paint the electronic door which covers one 3 x 4 metre end, nor the window, which is 2 metres wide and 1 metre high, nor the rear door which is 1 metre wide and 2 metres high. 1 litre of paint covers 3 square metres.
How many 1 litre tins will be needed to complete the painting?
A 21
B 18
C 22
D 25
E 26

13. Tom shared out some money between his three children in the ratio 5:3:2. He later had an extra €6
which he gave to the child who received the least originally. This meant that the money had been shared into one large and two equal smaller shares.
How much money in total did Tom give to the three children?
A €66
B €20
C €26
D €36
E €60

14. Three months ago, Jane had 5 times as many DVDs as Duncan. Since then they have both bought
12 more DVDs. Jane now has twice as many as Duncan.
How many DVDs does Jane have now?
A 32
B 42
C 52
D 62
E 72

15. There are four rivers in Bolandia, each claiming to be the longest. Tourist board brochures in the regions containing the rivers, make the following statements:
1. The Dile is shorter than the Cubba.
2. The Bongo is shorter than the Esun.
3. The Esun is longer than the Cubba.
If all of the above are correct, which one of the following statements is definitely true?
A The Esun is longer than the Dile.
B The Dile is shorter than the Bongo.
C The Cubba is longer than the Bongo.
D The Dile is longer than the Esun.
E The Bongo is longer than the Cubba.

16. The ingredients list on a tin of baked beans reads as follows (in order of descending weight):
- Navy beans (51%)
- Water
- Sugar
- Tomato puree (4.5%)
- Modified maize starch
- Salt
- Natural flavourings
- Onion powder
- Paprika

What is the maximum percentage of water the tin could contain?
A 40.0%
B 17.5%
C 22.2%
D 44.5%
E 49.0%

17. A significant social trend in the 20th century was for people to move away from their place of birth in
order to access education and work. This gave individuals more opportunities and helped the economy by producing mobility within the workforce. The negative side of this is now being felt as more and more elderly people face the problems of old age without family members nearby to care for them. This has negative effects on the economy as well as on the individual, as more and more state funding for care is needed.
Which one of the following could be drawn as a conclusion of the above passage?
A The benefits of a mobile workforce have to be compared with the costs to elderly people
and the economy.
B People should make caring for their elderly parents a priority over choice of work

opportunities.
C People should try to find education and work close to their place of birth.
D Elderly people are expecting the state to provide care for them rather than relying on their children.
E The state should provide care for elderly people to make mobility of the workforce possible.

18. A multi-storey car park has eight levels.
On the top seven levels there are eight rows of parking. Two of these rows hold 15 cars each whilst the others hold 10 cars each.
On the road level there are two rows holding 15 cars but only four rows holding 10 cars each.
The entry control system counts cars in and out. The system stops admitting cars once 90% of the total capacity is in use.
Four spaces on the road level are reserved for staff parking and these are not available to the public.
What is the maximum number of public cars which can be admitted?
A 626
B 500
C 630
D 644
E 696

19. After looking at interviews conducted with a number of adult learners, our research suggested that the learners who felt they were most successful were all highly motivated. We noticed that early success had heightened motivation in some cases and saw that both success and motivation may be due to a special aptitude for learning. We also noticed that many of those who felt they were most motivated were also learning in favourable conditions or for fun, which meant they may have become motivated since starting their classes. Though these conditions seemed persuasive, the results led us to the same conclusion. It's impossible to learn anything without motivation.
Which one of the following is **NOT** a flaw in the above argument?
A It assumes that in order to be motivated you have to have a special aptitude for learning.
B The research is only concerned with adult learners.
C It assumes that those who felt they were successful actually were.
D The research does not establish that there are no successful learners who lacked motivation.
E It assumes that those who felt they were motivated actually were.

20.Many people believe that foreign travel broadens the mind and that there is some inherent benefit
in spending some time in a culture different from your own. Many students are taking 'gap' years where they spend time in another country. Whilst this may offer some benefits in terms of confidence and independence, it is wrong to assume that foreign travel alone can provide this. Global travel can have negative impacts on local cultures and the environment. Home country based 'gap' projects are often seen as unglamourous but the benefit of working with different groups and cultures within our own society can be equally rewarding.
Which one of the following is the main conclusion of the above passage?
A Projects within our own society can be as rewarding as foreign travel.
B There is inherent benefit in spending some time abroad.
C It is important that gap year students consider the impact of their travel on the communities they work in.

D Foreign travel is not the only way to gain confidence and independence.
E Foreign gap year projects must have an element of community work for them to be worthwhile.

21. My packet of washing powder claims to contain enough powder for 24 washes. This claim is based
on using the plastic scoop supplied with the packet and filling it once for each wash.
Living in a soft water area I find I only need to fill the scoop three-quarters full.
How many washes can I get from this packet?
A 32
B 30
C 42
D 18
E 26

22. Modern technology has given us the power to use renewable natural resources faster than they can be replaced. The decline of fish numbers provides one example of the way in which modern technology can rapidly use up a natural resource. Modern fishing ships equipped with fish detecting systems and huge nets can gather up vast quantities of fish quicker than the sea can renew them. Because high technology gives us such harmful powers, we must learn to use the renewable resources of the earth carefully, rather than waste them.
Which one of the following best expresses the main conclusion of the above passage?
A Humans must preserve renewable resources by learning how to use them carefully.
B Fish need to be carefully protected to prevent them from being destroyed.
C Modern technology simply takes from the environment and destroys its resources.
D Most people are unaware of the damaging effects of modern technology.
E Fishing is now a serious threat to the world's environment and should cease

23. Shower gel is now used much more than soap when people take a shower. This is unfortunate. Shower gel requires much more packaging which means more rubbish. There is also a tendency for people to use more of it when washing in comparison with soap. Therefore more natural resources are consumed in the manufacturing process than would be if people used only soap. So, the trend towards shower gel is bad for the environment. This is because it creates more problems of waste disposal and uses up more resources than soap. We should make people more aware of the environmental impact of such simple decisions.
Which one of the following is an expression of the main conclusion of the above argument?
A People should be made more aware of the environmental consequences of choosing shower gel.
B It is unfortunate that shower gel has become more popular than soap.
C The manufacture of shower gel is more wasteful of natural resources.
D The increased popularity of shower gel is bad for the environment.
E The use of shower gel increases the problems of waste disposal.

24. The headquarters of the World Health Organisation (WHO) is found in which of these cities?
A Geneva
B Washington DC
C London

D Rome
E Nairobi

25. A placebo is:
A an inactive drug or treatment.
B a form of mild stimulant.
C a type of pain killer.
**D** a form of local anaesthetic.
E a sedative.

26. Which general famously crossed the Alps with his army?
A Hannibal
B Hamilcar
C Antony
D Octavius
E Augustus

27. In which modern day country was the Inca civilization centred?
A Peru
B Brazil
C Chile
D Ecuador
E Bolivia

BIOLOGY
28.

The table below shows the proportions of undigested and digested carbohydrates, fats and proteins in three regions of the digestive system.
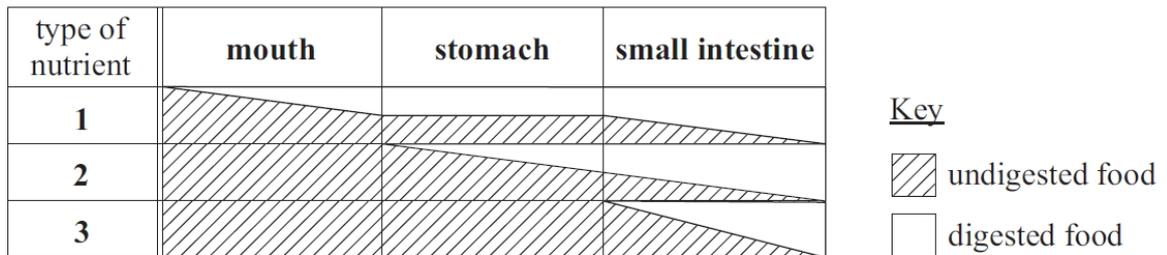
Which row of the table below correctly identifies the types of nutrient **1**, **2** and **3**?

A protein fat starch
B starch protein fat
C protein starch fat
D fat protein starch
E starch fat protein

29. The diagram shows the menstrual (oestrus) cycle for a human female who is not pregnant. During which period, **A**, **B**, **C** or **D**, will the concentration of oestrogen reach its highest

level?
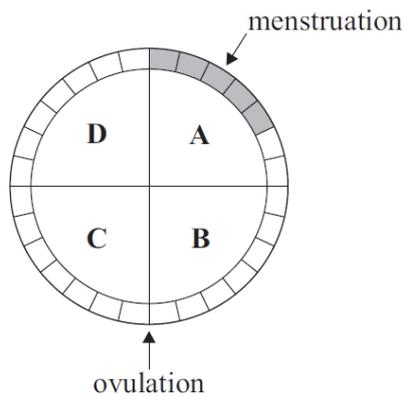
A B
B C
C A
D AB
E D

30. The diagram shows the inheritance of a condition in a family.
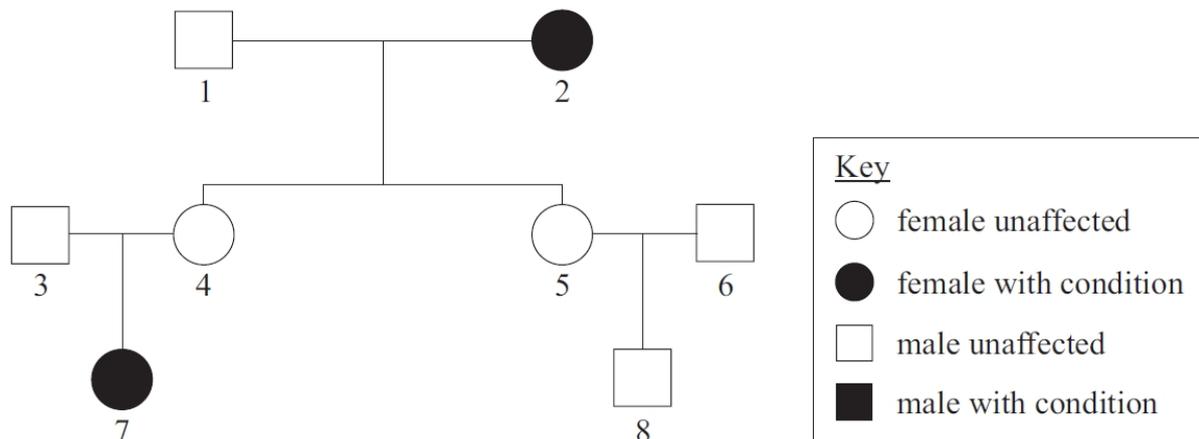
(i) Identify the three individuals who **must** be heterozygous for this condition.
(ii) What are the chances that a second child of individuals 3 and 4 will be a female who has this condition?
A 1 in 1 (100%)
B 1 in 2 (50%)
C 1 in 3 (33.3%)
D 1 in 4 (25%)
E 1 in 8 (12.5%)

31. The antidiuretic hormone (ADH) is produced by the pituitary gland and its target organ is the kidney. ADH leaves the head in the jugular vein.
In what order will the hormone pass through the following blood vessels to reach its target?
A aorta
B pulmonary artery
C pulmonary vein
D renal artery

E vena cava

32. A sample of DNA contains 30 % guanine.
Which answer shows the percentage of thymine in the same sample?
A 20
B 23
C 24
D 32
E 34

33. Which one of the following does not contain amino acids?
A Cellulose
B Enzymes
C Prokaryotic Cell
D Antibodies
E Cell membranes

34. A liver cell in the metaphase of mitosis can be identified as being eukaryotic because it has:
1. mitochondria
2. ribosomes
3. a nucleus
A 1 only
B 1 and 2 only
C 1 and 3 only
D 2 and 3 only
E 1, 2 and 3

35. Which of the following is/are true about hydrogen bonds between water molecules?
1. They are weak bonds.
2. They are strong bonds.
3. They are temporary bonds.
4. They require hydrolysis to break.
A 1 and 3 only
B 1 only
C 2 and 3 only
D 1 and 4 only
E 2 and 4 only

36. Which one of the following molecules will contain the greatest number of different elements?
A amino acids
B water
C lipids
D polysaccharide carbohydrates
E monosaccharide carbohydrates

37. In which of the following stages of mammalian respiration is CO2 released?
1. Glycolysis
2. Anaerobic respiration
3. Krebs cycle
A 2 and 3 only

B 1 only
C 1 and 2 only
D 2 only
E 3 only

38. Which one of the following is **NOT** correct about human chromosomes?
A They can attach to the spindle at the centriole.
B They are made of DNA and protein.
C They are sometimes found in pairs.
D They contain regions called genes.
E They are sometimes not found in pairs.

39. In a set of genetic crosses the offspring produced showed the same phenotype ratio of 9:3:3:1. Which of the following statements could be true?
1. two genes each with two alleles were studied
2. all parents were heterozygous
3. some offspring had a phenotype different to the parents
4. some offspring had a phenotype the same as the parents
A 1, 2, 3 and 4
B 3 and 4 only
C 1 and 2 only
D 1 only
E 2 and 3 only

40. Which of the following crosses is most likely to produce offspring of genotype AaBb?
A GGNn x GgNn
B AABB x aabb
C AABB x aaBb
D AaBb x aabb
E ggNn x GGNN

41. Which one of the following molecules is made in both photosynthesis and respiration?
A ATP
B Glucose
C Oxygen
D Carbon dioxide
E Reduced NADP

42. Gene expression can be regulated by:
A transcription factors
B RNA polymerase
C rough endoplasmic reticulum
D the position of the genes on the alleles
E DNA replication factors

CHEMISTRY

43. The mass of an atom of uranium is 4×10^{-25} kg.
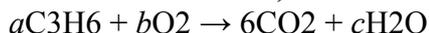What is the mass, in milligrams, of 8 million atoms of uranium?
A 3.2×10^{-18}
B 3.2×10^{-17}
C 3.2×10^{-16}
D 3.2×10^{-15}
E 3.2×10^{-12}

44. What values of a, b and c are needed to balance the equation?
aC3H6 + bO2 → 6CO2 + cH2O
A 2,9,6
B 1,3,3
C 2,9,8
D 1,9,3
E 4,5,8

45. The colours of three indicators are shown.

indicator	colour at		pH at which colour change takes place
	low pH	high pH	
methyl orange	red	yellow	4.0
bromothymol	yellow	blue	6.5
phenolphthalein	colourless	pink	9.0

Equal volumes of these three indicators were mixed and the mixture was added to a solution of pH 5.0. What colour would be seen?
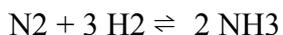A blue
B green
C orange
D yellow
E pink

46. Ammonia is manufactured from the reaction between nitrogen and hydrogen.
N2 + 3 H2 ⇌ 2 NH3
What is the maximum mass of ammonia that can be obtained from a mixture of 56 g of nitrogen with 9 g of hydrogen? (Relative atomic masses: H = 1; N = 14.)
A 34 g
B 51 g
C 65 g
D 68 g
E 38 g

47. In the citric acid cycle, succinic acid, C4H6O4, is converted into fumaric acid, C4H4O4. This is an example of which **one** of the following chemical changes?
A oxidation
B reduction
C neutralisation
D dehydration
E hydrolysis

48. The reactivity of the alkali metals (group 1) increases as the atomic number increases.

Which **one** of these statements is the correct explanation of this fact?
A The atoms have only one electron in the outer orbit / energy level.
B They are the most reactive of all the groups of metals in the periodic table.
C The number of neutrons in the nuclei increases.
D The atomic mass increases.
E The outer orbit / energy level is further from the nucleus.

49. The electronic configuration of an isolated, non-ionised, atom is shown below:
In which group and in which period of the periodic table is this atom situated?
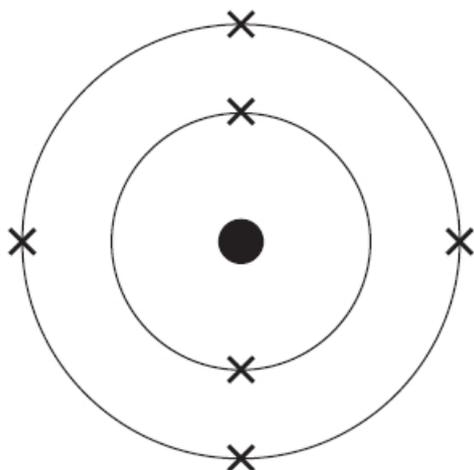

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    group period
A  2      4
B  2      6
C  4      2
D  4      6
E  6      2
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50. The enamel on teeth treated with fluorine may include fluoroapatite, which contains Ca^{2+}, PO_4^{3-} and F^- ions.
Which **one** of the following is a possible formula for fluoroapatite?
A $Ca(PO_4)F$
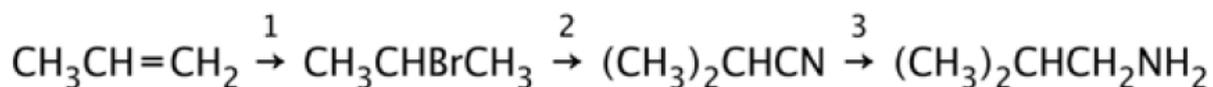**B** $Ca_3(PO_4)_2F$
C $Ca_5(PO_4)_3F$
D $Ca_7(PO_4)_5F$
E $Ca\ F$

51. What value does **c** need to be so that the following equation can be balanced?
$4KMnO_4 + aH_2SO_4 + 5C_2H_5OH \rightarrow 4MnSO_4 + bK_2SO_4 + 5CH_3CO_2H + cH_2O$
A 11
B 16
C 17
D 26
E 21

52. The compound $(CH_3)_2CHCH_2NH_2$ can be synthesised by the following route.
What types of reaction are used in stages 1, 2 and 3?

$$CH_3CH{=}CH_2 \xrightarrow{1} CH_3CHBrCH_3 \xrightarrow{2} (CH_3)_2CHCN \xrightarrow{3} (CH_3)_2CHCH_2NH_2$$

A 1=addition; 2=substitution; 3=reduction
B 1=addition; 2=substitution; 3=hydrolysis
C 1=addition; 2=addition; 3=reduction
D 1=substitution; 2=addition; 3=hydrolysis
E 1=substitution; 2=addition; 3=reduction

PHYSICS AND MATHEMATICS

54. The diagram shows a uniform beam pivoted at its centre. The bar weighs 800N, and three other forces act on it as shown. Distance x can be varied.
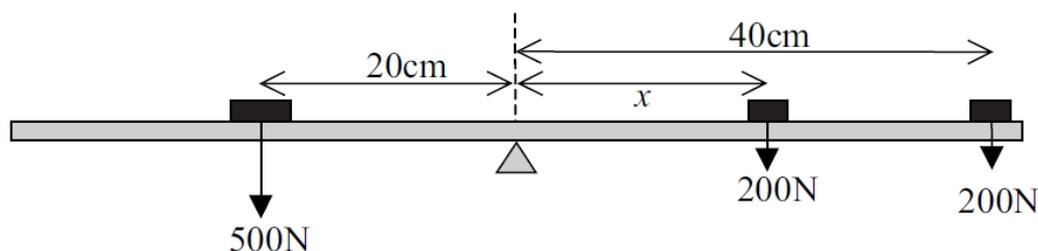
What value of distance x would cause the beam to be balanced?
A 5 cm
B 10 cm
C 20 cm
D 30 cm
E 40 cm

55. A horse of weight 6000 N gallops at a speed of 16 m/s. Taking the acceleration of free fall as 10 m/s2, calculate the kinetic energy of the horse. (Give your answer in kJ.)
A 76.8
B 77.8
C 110
D 24,6
E 80,8

56. Three resistors of equal value are connected up as shown.
A B C D
Arrange the letters corresponding to the four combinations in increasing order of resistance (least resistance first).
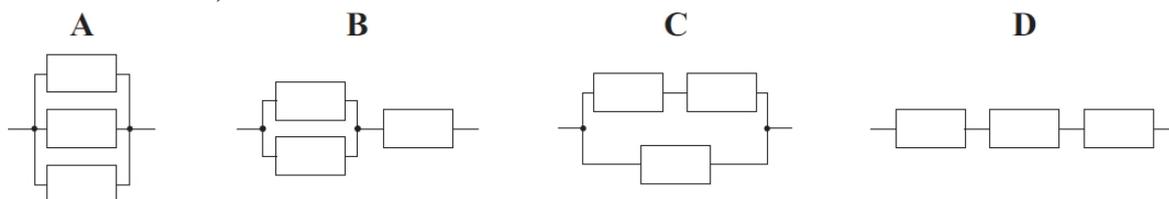
A   B   C   D

A A C B D
B C A B D
C A B C D
D A D B C
E B C D A
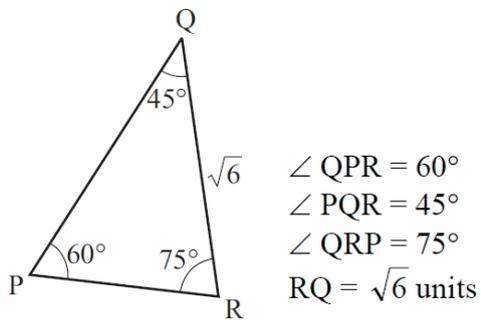
57. Solve the inequality
$x^2 \geq 8 - 2x$
A $x \geq 4$
B $x \leq 2$ and $x \geq -4$
C $x \geq -2$ and $x \leq 4$
D $x \geq 2$ or $x \leq -4$
E $x = 4$

58. In triangle PQR

$\angle$ QPR = 60°
$\angle$ PQR = 45°
$\angle$ QRP = 75°
RQ = $\sqrt{6}$ units

Given that cos 60° is ½, find the length of side PR. (The diagram is not drawn to scale.)
A 2
B $\sqrt{3}$
C $\sqrt{2}$
D $\sqrt{6}$

59. What is the set of values for which $12 - x2 > 8$ and $2x + 3 \geq 5$?
A $1 \leq x < 2$
B $-1 \leq x < 2$
C $2 < x$
D $1 < x \leq 2$
E $1 \leq x$

60. What is the set of values of x for which $x2 < 9$ and $2x + 3 \geq 5$?
A $1 \leq x < 3$
B $x > 3$
C $x > -3$
D $x < -3$ or $x \geq 1$
E $x \geq -1$