

January 2012

# Examiners' Report

## NEBOSH National Diploma in Occupational Health and Safety (Unit B)



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# **Examiners' Report**

## **NEBOSH NATIONAL DIPLOMA IN OCCUPATIONAL HEALTH AND SAFETY**

### **Unit B: Hazardous agents in the workplace**

**JANUARY 2012**

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## Introduction

NEBOSH (The National Examination Board in Occupational Safety and Health) was formed in 1979 as an independent examining board and awarding body with charitable status. We offer a comprehensive range of globally-recognised, vocationally-related qualifications designed to meet the health, safety, environmental and risk management needs of all places of work in both the private and public sectors. Courses leading to NEBOSH qualifications attract over 25,000 candidates annually and are offered by over 400 course providers in 65 countries around the world. Our qualifications are recognised by the relevant professional membership bodies including the Institution of Occupational Safety and Health (IOSH) and the International Institute of Risk and Safety Management (IIRSM).

NEBOSH is an awarding body to be recognised and regulated by the UK regulatory authorities.

Where appropriate, NEBOSH follows the latest version of the *“GCSE, GCE, Principal Learning and Project Code of Practice”* published by the regulatory authorities in relation to examination setting and marking (available at the Ofqual website [www.ofqual.gov.uk](http://www.ofqual.gov.uk)). While not obliged to adhere to this code, NEBOSH regards it as best practice to do so.

Candidates' scripts are marked by a team of Examiners appointed by NEBOSH on the basis of their qualifications and experience. The standard of the qualification is determined by NEBOSH, which is overseen by the NEBOSH Council comprising nominees from, amongst others, the Health and Safety Executive (HSE), the Confederation of British Industry (CBI), the Trades Union Congress (TUC) and the Institution of Occupational Safety and Health (IOSH). Representatives of course providers, from both the public and private sectors, are elected to the NEBOSH Council.

This report on the examination provides information on the performance of candidates which it is hoped will be useful to candidates and tutors in preparation for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content and the application of assessment criteria.

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## General comments

Many candidates are well prepared for this unit assessment and provide comprehensive and relevant answers in response to the demands of the question paper. This includes the ability to demonstrate understanding of knowledge by applying it to workplace situations.

There are always some candidates, however, who appear to be unprepared for the unit assessment and who show both a lack of knowledge of the syllabus content and a lack of understanding of how key concepts should be applied to workplace situations.

In order to meet the pass standard for this assessment, acquisition of knowledge and understanding across the syllabus are prerequisites. However, candidates need to demonstrate their knowledge and understanding in answering the questions set. Referral of candidates in this unit is invariably because they are unable to write a full, well-informed answer to one or more of the questions asked.

Some candidates find it difficult to relate their learning to the questions and as a result offer responses reliant on recalled knowledge and conjecture and fail to demonstrate a sufficient degree of understanding. Candidates should prepare themselves for this vocational examination by ensuring their understanding, not rote-learning pre-prepared answers.

### Common pitfalls

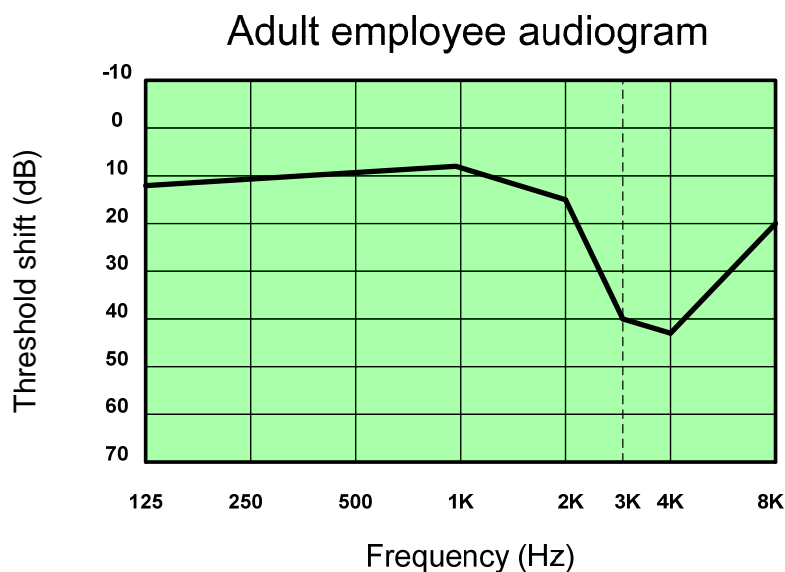
It is recognised that many candidates are well prepared for their assessments. However, recurrent issues, as outlined below, continue to prevent some candidates reaching their full potential in the assessment.

- Many candidates fail to apply the basic principles of examination technique and for some candidates this means the difference between a pass and a referral.
- In some instances, candidates do not attempt all the required questions or are failing to provide complete answers. Candidates are advised to always attempt an answer to a compulsory question, even when the mind goes blank. Applying basic health and safety management principles can generate credit worthy points.
- Some candidates fail to answer the question set and instead provide information that may be relevant to the topic but is irrelevant to the question and cannot therefore be awarded marks.
- Many candidates fail to apply the command words (also known as action verbs, eg describe, outline, etc). Command words are the instructions that guide the candidate on the depth of answer required. If, for instance, a question asks the candidate to 'describe' something, then few marks will be awarded to an answer that is an outline. Similarly the command word 'identify' requires more information than a 'list'.
- Some candidates fail to separate their answers into the different sub-sections of the questions. These candidates could gain marks for the different sections if they clearly indicated which part of the question they were answering (by using the numbering from the question in their answer, for example). Structuring their answers to address the different parts of the question can also help in logically drawing out the points to be made in response.
- Candidates need to plan their time effectively. Some candidates fail to make good use of their time and give excessive detail in some answers leaving insufficient time to address all of the questions.
- Candidates should also be aware that Examiners cannot award marks if handwriting is illegible.
- Candidates should note that it is not necessary to start a new page in their answer booklet for each section of a question.

## UNIT B – Hazardous agents in the workplace

### Section A – all questions compulsory

**Question 1** The figure below shows an audiogram for an adult employee.



- (a) **Explain** what is meant by 'threshold shift'. (2)
- (b) **Outline** the significance of the shape of the audiogram. (2)
- (c) **Outline** the benefits **AND** limitations of audiometry as part of a hearing conservation programme. (6)

In answering part (a) of the question, candidates could have explained that threshold shift is the difference between the hearing threshold of a subject and the hearing threshold of an average young adult with healthy, disease free ears. There were some reasonable answers for this part of the question although a few candidates did not appear to have a clear understanding of the term 'threshold shift'.

Good answers to part (b) would have outlined that the shape of the audiogram is typical of noise induced hearing loss with a 4 KHz notch indicative of a dip between 3 – 6. There were some candidates who did not recognise that this was an audiogram of someone suffering from noise induced hearing loss and assumed that any deficiency was caused by old age.

For part (c), in outlining the benefits of audiometry, candidates were expected to include: that it provides evidence of the effectiveness of a hearing conservation programme; that pre-employment or baseline screening identifies those with existing problems; that it enables identification of susceptible individuals and early signs of hearing loss; it provides an opportunity to inform employees about noise induced hearing loss and methods of prevention; and it may lead to reduced insurance premiums and provides information that can be used to defend civil claims. Its limitations are: that it is not preventive since some damage has to occur before the problem is identified; it may encourage claims; it diverts resources away from noise control; it is subject to inaccuracy, because of operator competence or the time of day and abuse; it detects hearing loss but not the source of noise induced hearing loss and would experience difficulty in establishing trends if the workforce is transient. Most candidates were able to give a satisfactory outline of the benefits and limitations of audiometry.

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**Question 2**     *The most widely used and accepted index for the assessment of heat stress in industry is the Wet Bulb Globe Temperature (WBGT) index.*

- (a)     **Identify** the measurements that need to be taken to determine the WBGT index. (3)
  - (b)     **Outline** the principle of operation of the instruments that should be used to make the measurements. (7)
- 

In answer to part (a) the necessary measurements include the wet bulb temperature, the air or dry bulb temperature and the radiant or globe temperature. There were a number of candidates who did not seem to know what measurements were required to determine the WBGT index.

For part (b), candidates were expected to outline that for the wet bulb temperature, a thermometer with the bulb wrapped in a wetted cloth or sock is used. The water evaporates from the bulb causing it to cool. The bulb cools to below the ambient temperature giving a measured wet bulb temperature. Air temperature is measured using an alcohol/mercury or digital thermometer. The liquid in the tube expands as the temperature rises and a reading obtained from a marked scale or digital display. A black globe thermometer is used to measure radiant temperature. A mercury filled thermometer is encased in a black painted copper sphere and the radiant heat is absorbed without being influenced by air currents. Knowledge of the operation of the necessary instruments was vague with some describing the operation of a hygrometer rather than a wet bulb thermometer.

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**Question 3**     *Manual handling risk assessments should consider a range of risk factors including those concerning the task and the load.*

**Explain** how risk factors, within the headings of task **AND** load, relate to nursing staff who carry out manual handling activities when assisting hospital patients with limited mobility. For **EACH** risk factor explained **give** an example relevant to this situation. (10)

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This question asked candidates to consider how, in carrying out a manual handling risk assessment, the risk factors concerning the task and load might relate to nursing staff carrying out manual handling activities when assisting patients with limited mobility.

In considering the task, the nurses would have to assist the patients to carry out a number of tasks such as bathing, washing and dressing and these activities would frequently involve stooping, bending, stretching, pulling and lifting, and may involve work at different levels such as beds or trolleys and so often resulting in the staff needing to adopt awkward postures. The tasks are carried out frequently and often for prolonged periods dependent on the shift length and the number of patients requiring care, and often the work involved the use of equipment such as lifting aids and hoists. Additionally, some tasks may involve team handling and/or involve moving a long distance such as ward to ward or ward to theatre.

In considering the load factor, this might be difficult to assess or estimate, since no two persons are the same, often the load is likely to be deadweight since many patients can do little for themselves and on occasions the patient load may become awkward as the centre of gravity shifts. Additionally, the patient's movements may be unpredictable, and while some may have lapsed into unconsciousness, others may struggle, become unwilling to be assisted and may even become violent. There is also the possibility that medical apparatus such as drips or splints could be attached to the patient that could make it difficult to secure a grip and particularly so if the patient is again uncooperative.

This question was not well answered by the majority of candidates with only a few seeming to have an appreciation of the scenario described. Some failed to differentiate between task and load in their responses although others did describe individual and environment factors which of course were not required. The question required candidates to provide a relevant example for each risk factor identified. Some did not comply with this request while others who did often neglected to link the example with any particular risk factor.

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**Question 4**     *A healthcare research laboratory undertakes work with hazard group 3 biological agents which require containment level 3 controls.*

**Outline** a range of technical controls that should be used to minimise the risks to those working in the laboratory, where elimination or substitution of the hazard is not possible.

(10)

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In answering this question, candidates were expected to outline technical control measures such as: the separation of the laboratory from other activities in the same building; passing extracted air through a HEPA (high efficiency particulate air) filter; the provision of engineered access to be restricted to authorised persons by means of a security pass or swipe card; the workplace to be sealable to permit disinfection and to be maintained at an air pressure negative to atmosphere; all surfaces to be impervious to water, easy to clean and impervious to acids, alkalis, solvents and disinfectants; the provision of secure storage for the biological agents; an observation window to be fitted so that the occupants can be seen at all times; using a class 111 microbiological safety cabinet with sealed front and glove port access to carry out the work; a facility such as an autoclave to be provided for rendering waste safe and finally the provision of appropriate and adequate washing and toilet facilities.

This question was well answered by many candidates although some did confuse the controls with level 4 controls. Despite the wording, some answers included reference to procedural controls which were not required. This was an outline question and required supporting detail for references to an 'airlock', 'filtered air' and 'welfare facilities'. The demand was not met by the frequent use of the word "appropriate" without further definition.

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**Question 5**     *A grounds maintenance contractor is selecting eye protection to wear during grass strimming.*

- (a)     **Describe** the specific features of the eye protection required for this task. (7)
- (b)     **Outline** the arrangements the grounds maintenance contractor should put in place when the selected eye protection is in use. (3)
- 

In carrying out the task described, the probability would be that impact might come from a variety of directions and as a consequence goggles or a face shield should be selected as eye protection. They would need to have good mechanical and impact strength, be shatterproof with medium energy impact (B), be adjustable to allow appropriate fit and comfort and be compatible with other personal protective equipment such as hearing, head or respiratory protection. Other possible features to be considered would be the optical class of the lenses and their resistance to misting and surface damage, and the resistance of the frames to dusts. Finally the protection should be CE marked and comply with a recognised standard.

For part (b), once the selected protection is in use, arrangements should be made for the provision of training in its use and its correct fitting with other equipment; for the cleaning and storage of the equipment and for reporting defects and providing replacements when these are seen to be necessary. Additionally, measures should be taken to ensure that the protection is used at all times when grass strimming is being carried out with disciplinary action being taken for non-use.

Answers to this question were to a reasonable standard although some candidates made little reference to technical information concerned with resistance to impact and the optical class of the lens.

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**Question 6**     *Human epidemiology and animal studies are methods that can be used to investigate whether a substance is carcinogenic.*

- (a)     **Outline** the advantages of **EACH** of these methods. (3)
- (b)     **Outline** the disadvantages of **EACH** of these methods. (7)
- 

In answer to part (a) of the question, candidates could have pointed out that human epidemiology is a definitive method for identifying human carcinogens, is based on experience in actual populations and can be done retrospectively. The advantages of using animal studies on the other hand include the fact that this method avoids human exposure and hence possible human risk; the data can be collected more quickly than by using epidemiological methods; the animal study environment can be better controlled; and animals provide the best available models as, biochemically, they relate more closely to humans.



For part (b), one of the disadvantages of using human epidemiology, apart from its cost and the amount of time it takes, is that it usually requires large populations in order to reduce random sampling errors that may otherwise distort the real underlying picture; it suffers from problems of sensitivity – how well it can detect those either with the disease or the effect of the substance being tested – and conversely specificity – how well it can detect those without the disease or the effect. Additionally, human epidemiology may rely on poor or inaccurate historical records; the study may be affected by lifestyle factors; it is not very useful for assessing completely new substances since latency periods may be extensive and finally the study might be affected by potentiation together with synergistic, additive or antagonistic effects.

The disadvantages of animal studies include the fact that the dose/response effect may vary in different animal species and so extrapolating data to humans may not always be reliable. Additionally, conducting animal studies can be time-consuming and expensive dependent on the species used and there are often ethical considerations and public opinion that can make this approach more difficult to undertake.

Answers to this question were generally reasonable. There was, however, some misunderstanding of human epidemiology with some considering that it was concerned with testing carcinogens on humans. Some candidates outlined the advantages and disadvantages of in vitro testing which was not required.

### Section B – three from five questions to be attempted

**Question 7** *Drug and alcohol misuse can adversely influence performance at work, even when the misuse takes place outside of the workplace.*

- (a) **Outline** specific signs that an employer can look for when attempting to identify if an employee has a drug or alcohol misuse problem. (7)
- (b) You have been asked to liaise with an occupational health professional to prepare a company policy on drug and alcohol misuse, which will include reference to drug and alcohol testing.
  - (i) **Identify** the situations in which it may be appropriate for an employer to introduce an employee drug and alcohol testing programme. (3)
  - (ii) **Outline** the other key points that should be included in the company policy on drug and alcohol misuse. (10)

Specific signs an employer might look for in attempting to identify if an employee has a drug or alcohol misuse problem include: sudden mood changes, unusual irritability or aggressive or erratic behaviour; a tendency to become confused; abnormal fluctuations in concentration and energy levels; impaired job performance and a tendency to suffer an increased number of accidents; poor time keeping; an increase in short term sickness absence; deterioration in relationships with colleagues, customers or managers; dishonesty or theft; the smell of alcohol or the presence of drugs paraphernalia; slurred speech and poor coordination; a change in appearance, for example becoming scruffy when previously the employee had been well groomed and the appearance of needle marks or the covering of limbs in an attempt to hide them and dilated pupils or blood-shot eyes. This was a very popular question and part (a) was generally well answered.

For part (b)(i), candidates were expected to identify situations such as pre-employment as part of the job selection process; as an on-going deterrent where employees have a safety critical role such as train drivers or track side workers; following an accident or incident where it is suspected that drugs or alcohol might have been a factor; as part of a rehabilitation or return to work programme and in situations where drug or alcohol misuse has been identified as a problem, for example where evidence of the specific signs identified in answers to the first part of the question has been noted. Again this part of the question produced some good answers although there were a few candidates who listed jobs where drugs might be a problem rather than the required situations.

For (b)(ii), candidates should have outlined key points to be included in the company policy such as: a general statement of aims, for instance the employer expects all employees to ensure that drug misuse does not have a detrimental effect on their work; responsibilities for carrying out the policy (managers, employees, occupational health counsellors etc) and who is covered by the policy (employees, contractors, visitors); a definition of drug misuse that includes misuse of prescription drugs as well as prohibited drugs; a statement of the rules that will apply such as the prohibition on drinking at lunch time and the response to possession or dealing of drugs in the workplace; the requirement for notification to management by those employees taking prescription drugs; a reporting procedure for employees if they suspect colleagues are taking or are under the influence of drugs; the procedures to be followed after a positive test or a refusal to take a test with a clear statement on the sanctions to be taken in such circumstances; particulars of the support and help available to employees who have a drug problem together with the recognition that treatment may result in absence which will be treated as normal sick leave; details of arrangements for re-instatement and return to work following treatment and a statement assuring employees of confidentiality. Candidates found this part of the question more challenging. Answers were generally not broad enough with some candidates concentrating solely on testing procedures despite the wording of the question – ‘other key points.’ Others discussed management strategy, for example, consultation procedures rather than the content of a company policy while there were a few who discussed only the facilities and arrangements for testing and the assignment of responsibility to and the qualifications of personnel.

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Question 8	(a) <b>Outline</b> the structure of the skin. (6)
	(b) <b>Outline</b> how hazardous substances can enter the body through the skin. (4)
	(c) Construction company employees regularly lay floors and use a cement-based levelling compound which contains chromium VI. Several of the long term employees and one of the new recruits have complained about red and sore skin on their hands.
	(i) <b>Explain</b> the possible reasons for the symptoms they are now experiencing. (6)
	(ii) <b>Outline</b> control measures that could be used to minimise these symptoms in this situation. (4)

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The skin is made up of three layers the epidermis, consisting of dead cells that are continually shed and provide protection for the inner layer, the dermis comprising living cells and containing blood capillaries, nerve endings, and sweat sebaceous glands; and the subcutaneous layer containing arteries, veins and fat. Some candidates omitted to refer to the subcutaneous layer and there were a few who obviously had little knowledge of the structure.

For part (b), candidates were expected to outline that the skin is partially permeable and substances that are soluble in water or fat may migrate or be absorbed through the skin and enter the blood stream and have a systemic effect. Hazardous substances may also enter via cuts or abrasions while corrosive substances can burn through the layers of skin and enter the blood stream. There is also the possibility that substances can enter the body by injection such as in the use of needles. Most candidates had little difficulty with this part of the question but only a few recognised the effects of a corrosive substance while there were a number who ignored the reference to 'through the skin' and described entry by inhalation and ingestion.

For part (c), candidates should have explained that the symptoms suggest that the employees have contracted dermatitis since cement is a well-known irritant that may cause this disease. The longer term employees may be suffering from irritant contact dermatitis caused by chronic or repeated exposure to an irritant which ultimately de-fats and de-greases the skin and overcomes the skin's own defence and repair systems. The symptoms may also be caused by allergic contact dermatitis following contact with a sensitizer, for example, the chromium compound impurities within the cement which produces an over-reaction from the body's immune system. Sensitisation can occur following the first contact as with the new recruit or after some time as with the longer term employees. Further reasons for the symptoms include caustic burns and friction from the general floor laying process. Answers to this part of the question were limiting. Most recognised dermatitis but did not distinguish between irritant contact and allergic contact dermatitis with few recognising caustic burns or friction as a possible cause.

Most candidates, however, were able to outline control measures that might be used to minimise the symptoms including the use of a non-cement levelling compound such as a polymeric product; minimising contact with the material by the use of hand tools and wearing gloves; washing contaminants from the skin as soon as possible and drying the skin thoroughly after washing; using pre and after work moisturising creams to replenish oils; informing the employees of the hazards associated with the operation and the precautions to be taken; and encouraging them to report any skin problems; and arranging for supervisors to carry out regular skin inspections of the workforce.

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#### Question 9

*It is often necessary to monitor an employee's personal exposure to hazardous substances. Some of the measurement principles that can be used include gravimetric analysis, microscopy and chemical analysis.*

*For EACH of these measurement principles:*

- (a) **identify** a type of hazardous substance for which it can be used **AND suggest** a typical workplace situation where such a measurement may be necessary; (6)
  - (b) **outline** the type of equipment **AND** the methodology used to determine the employee's personal exposure to the hazardous substance. (14)
- 

For part (a) of the question, candidates should have identified that the gravimetric method for measuring personal exposure to hazardous substances may be used for measuring total inhalable or respirable dusts for instance in a woodworking workshop or in the manufacture of chemicals. Microscopy would be used for the measurement of fibres such as following the accidental disturbance or planned removal of asbestos. Chemical analysis is used in the measurement of gases, vapours and fumes in workplaces such as laboratories or those involved in the manufacture of chemicals.

Part (b) asked candidates to outline the equipment and methodology used in each of the three monitoring methods. With gravimetric, a filter attached to a pump is used.

There are three main types of sample head depending on the type of dust being determined. These are the multi-orifice (7 hole) sampler, the IOM inspirable dust sampler and the cyclone head. The filter is weighed before and after sampling and the concentration, expressed in  $\text{mg}/\text{m}^3$ , is determined from the weight gain and the volume of air used. With microscopy, a membrane fitted on an appropriate sampling head such as a cowl is attached to a pump. After sampling is completed, a phase contrast microscope is used to count the fibres. The number of fibres in a known proportion of the sample is calculated and extrapolated to the whole sample with the result being expressed as fibres per millilitre of air (f/ml). As far as chemical analysis is concerned, a tube or sampling head with a filter impregnated with an adsorbing material such as charcoal, tenax or silica is attached to a pump. After sampling it is desorbed and analysed in a laboratory. The analysis techniques which can identify both the chemical and its concentration include mass spec or IR spectrometry and gas chromatography. Concentrations are expressed in parts per million or milligrams/ $\text{m}^3$ .

General points associated with each monitoring method include the necessity: to calibrate the pumps used; to draw a known volume of air through the filter or tube; to take a number of samples to minimise errors in measurement; to ensure the sampling head was placed in the breathing zone and to use the appropriate methods (MDHS) for determining the hazardous substances.

This was not a popular question but those who attempted it generally did well. Chemical analysis was probably the least well understood with a few suggesting that it involved the use of a draeger tube while it was not always recognised that microscopy involved a fibre count.

**Question 10** Methanol (an organic solvent) is being used in the production of a specialist coating.

An employee's measurement of exposure to methanol varies throughout their 8-hour working day. The results of measurement of their exposure are as follows:

**Table 1**

Task undertaken by employee	Duration of task	Exposure to methanol (ppm)
Measuring out and adding methanol	15 minutes	320
Adding other components to the mix	1 hour	100
Supervision of mixing and decanting	2 hours	125
Clean down of equipment using solvents	3 hours	150

Assume that exposure is zero at all other times.

- (a) **Calculate** the 8-hour Time-Weighted Average (TWA) exposure to methanol for the employee. Your answer should include detailed working. (8)

Information relating to methanol in EH40 Workplace Exposure Limits is as follows:

**Table 2**

Substance	CAS Number	Workplace Exposure Limit				Comments
		Long-term exposure limit (8-hour TWA limit reference period)		Short-term exposure limit (15-minute reference period)		
		ppm	mg/m <sup>3</sup>	ppm	mg/m <sup>3</sup>	
Methanol	67-56-1	200	266	250	333	Sk R11, 23/24/25, 39/23/24/25

- (b) **Outline** the following terms: (2)
- (i) Chemical Abstract Services (CAS) number; (2)
- (ii) Short-term exposure limit (15-minute reference period). (2)
- (c) Using your results from part (a), the original exposure information in Table 1 and by selecting the relevant data from Table 2, **explain** what actions might be required by the employer in order to comply with the Control of Substances Hazardous to Health (COSHH) Regulations 2002. (8)

For part (a), marks were available to candidates who calculated the TWA exposure correctly and included the detailed working in their answers such as:

$$[(320 \times 0.25) + (100 \times 1) + (125 \times 2) + (150 \times 3) + (0 \times 1.75)] \text{ divided by } 8 \text{ giving } (80 + 100 + 250 + 450 + 0) / 8 = 880 / 8 = 110 \text{ ppm.}$$

There were some good answers provided for this part of the question. If marks were lost it was by reason of an arithmetical error or confusion with the units of time.

In answering part (b), candidates were expected to outline that a CAS number is a unique number, recognised internationally, which is assigned to identify a particular chemical, thus avoiding confusion between chemicals with similar names.

A short term exposure limit (15 minute reference period) represents the maximum permissible exposure by inhalation in a 15 minute period. This is relevant where substances may cause adverse and acute effects after a brief exposure. For substances with no assigned short term exposure limit (STEL), it is usual to apply a figure of three times the long term exposure limit (LTEL) as a guideline. It appeared that many candidates had a poor understanding of the term STEL and particularly the fundamental point that it is used where brief exposures may cause adverse effects.

In answering the last part of the question, candidates needed to apply the results they had provided for part (a) with the additional information contained in Table 2, to determine whether the employer needed to take any action to comply with the requirements of the COSHH Regulations of 2002. They should have concluded that the long term exposure did not exceed the WEL and it would therefore be sufficient to continue with and monitor the existing control measures. However, the short term exposure limit was exceeded during the time when the employee was measuring out and adding the methanol and consequently further control measures would be required for that part of the process. These might include, for example, substitution with a less hazardous substance; automatic dispensing of the solvent; installing local exhaust ventilation or improving its efficiency if already installed; wearing respiratory protective equipment to reduce inhalation and personal protective equipment to avoid splashing to the skin since the reference to SK indicates that the substance may enter the body through the skin. It may also be prudent to measure the level of exposure to other components and to compare with their respective WELs and to investigate any possible synergistic or additive effects. A few candidates did not appear to notice the reference to the use of results from part (a) and described the general duties of COSHH for no reward.

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<b>Question 11</b>	(a)	<b>Identify</b> the possible health effects from exposure to ionising radiation.	(5)
	(b)	<b>Outline</b> the control measures that should be in place where persons may be exposed to ionising radiation at work.	(15)

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Part (a) produced some reasonable answers with many candidates able to identify that the possible health effects from exposure to ionising radiation will depend on the type of radiation and the frequency and duration of exposure and will include nausea, vomiting, dermatitis, burns either superficially to the skin or more penetrating burns causing cell damage, cataracts, temporary or permanent infertility, decreased immunity, cancer induction, hair loss and blood disorders.

Control measures that should be in place where persons may be exposed to ionising radiation at work include limiting the time of exposure with the exclusion of particularly vulnerable groups such as young persons and pregnant women; the use of sealed sources whenever possible; increasing the distance between the radiation source and those at risk to reduce the level of exposure; using shielding between the radiation source and those likely to be exposed with the amount of shielding required dependent on the energy of the source; prohibiting eating and drinking in unsealed radioactive areas together with the need for a high standard of personal hygiene to prevent spread such as the provision of separate clean and dirty changing rooms, and the covering of all breaks in the skin with protective material; the provision, use and laundering of personal protective equipment such as gloves, lab coats and over shoes; the availability of competent advice from a Radiation Protection Adviser or Supervisor and the provision of training and information to employees on the health risks involved and the control measures to be applied; personal monitoring by means of film badges; regular monitoring of the work area for example by means of a Geiger counter and ensuring the safe disposal of all contaminated materials.

Most candidates provided acceptable answers for the second part of the question although some gave the impression that they did not have a good understanding of the difference between ionising and non-ionising radiation since there was the occasional reference to sun beds and lasers. Candidates should take particular note of the command word – in this case ‘outline’ since there were a number of references to generic control measures such as personal protective equipment and health surveillance. These references alone without further detail were not sufficient to gain the marks available.



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